ATTACHMENT 10
Air Quality Technical Report

Glassboro-Camden Line FEIS
February 2021

Prepared by:

Prepared for:

Project information contained in this document, including estimated limits of disturbance that could result with construction or operation of the proposed GCL, is based on conceptual design parameters that represent a reasonably conservative basis for conducting environmental analyses. As the proposed GCL is advanced through preliminary engineering and construction, efforts will continue to be made to further refine the design and minimize the project footprint. These refinements may result in the potential to avoid and further reduce the adverse effects outlined in this document and as described within this Environmental Impact Statement.

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Acronyms

CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CFR	Code of Federal Regulations
DE	Diesel exhaust
DMU	Diesel multiple units
DRPA	Delaware River Port Authority
DVRPC	Delaware Valley Regional Planning Commission
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
GCL	Glassboro-Camden Line
GHG	Greenhouse Gas
HEI	Health Effects Institute
IRIS	Integrated Risk Information System
LOS	Level of service
LRTP	Long Range Transportation Plan
MOVES	Motor Vehicle Emission Simulator
MSAT	Mobile source air toxics
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NJDEP	New Jersey Department of Environment Protection
PAH	Polycyclic aromatic hydrocarbon
POM	Polycyclic organic matter
SIP	State Implementation Plan
TIP	Transportation Improvement Program
VMF	Vehicle Maintenance Facility
VMT	Vehicle miles traveled
VOC	Volatile Organic Compounds
WRTC	Walter Rand Transportation Center

Foreword

Following the issuance of the Draft Environmental Impact Statement (November 2nd, 2020), revisions have been made to this Technical Report (Attachment 10, "Air Quality Technical Report") in preparation of the Final Environmental Impact Statement as follows:

- Section 4.2, Page 24: Removed "the latest version of," from the following sentence: "A regional analysis was performed for the project using the latest version of the EPA's Motor Vehicle Emission Simulator (MOVES) emissions program, MOVES2014a to determine roadway emissions and project specific emission rates for the Stadler light diesel multiple units (DMU), 450 kw engine, the proposed transit engine for the project."
- Section 4.4, Page 28: Removed "the most recent version of," from the following sentence: "The most recent version of the EPA Motor Vehicle Emission Simulator (MOVES2014a) and the CAL3QHC (Version 2.0) air quality dispersion model were used to estimate existing, future No-Action and the future GCL CO levels at selected locations in the project area."
- Section 4.4, Page 30: Removed "the latest version of," from the following sentence: "Emission factors were developed using the latest version of the EPA's MOVES program, MOVES2014a. MOVES2014a is the EPA's state-of-the-art tool for estimating emissions from highway vehicles."
- Section 4.4.1, Page 34: Revised "Parking facilities are proposed at eight stations," as follows: "Of the fourteen proposed GCL stations, nine will be served by existing or proposed parking facilities (structures or surface parking lots). Parking facilities (surface lots) will be constructed at six stations as part of the proposed GCL (South Camden, Gloucester City, Crown Point Road, Woodbury Heights, Mantua Boulevard, and Mantua-Pitman). Two stations (Woodbury and Glassboro) will be served by existing municipal parking structures, and one station (Red Bank Avenue) will be served by an existing municipal parking lot. (Mantua-Pitman Station will be served by a parking lot constructed as part of the GCL, which if and as demand calls for, may be developed in the future as a parking structure.) In sum, approximately 2,685 new parking spaces in 2025 and 4,310 spaces in 2040 would be available for GCL use. The type and size of the proposed GCL parking facilities are shown in Table 7, "Proposed GCL Parking Facilities." Parking facilities identified as "GCL" would be constructed as a part of the proposed project. Facilities identified as "Shared" are either existing or planned as part of municipal redevelopment master plans, and though not part of the proposed project, would provide parking spaces for use by GCL riders.
- Section 4.4.1, Page 35: Updated Table 7, "GCL Parking Facilities," with revised number of parking spaces, totaling 4,310
- Section 5, Page 46: Added additional sources to the references list
- Section 5, Page 46: Updated the website address for the EPA air emission sources
- Minor editorial and typographical revisions, as well as formatting adjustments, have been made as appropriate

1 INTRODUCTION

This attachment describes the existing conditions regarding air quality within the study area for the proposed Glassboro-Camden Line (GCL) and describes the consequences related to air quality of the proposed project. The environmental consequences section details the results of analyses performed, and discusses potential effects associated with the GCL. Mitigation measures to minimize potentially significant impacts are also discussed.

1.1 Project Description

The GCL Project is a proposed 18-mile expansion of transit service in Southern New Jersey that would traverse eleven communities between Camden City and Glassboro Borough. These communities, listed from north to south, include the following within Camden County - Camden City, Gloucester City, and Brooklawn Borough - and the following communities within Gloucester County - Westville Borough, Woodbury City, Woodbury Heights Borough, Deptford Township, Wenonah Borough, Mantua Township, Pitman Borough, and Glassboro Borough.

The GCL would restore passenger rail service primarily within an existing Conrail freight right-of-way (ROW) using light rail vehicles similar to the NJ TRANSIT River LINE. The light rail would operate on new dedicated tracks with peak service operating every 15 minutes. There would be two dedicated tracks in Camden and one dedicated track between Camden and Woodbury with a passing siding in Westville and Woodbury. South of Woodbury, the GCL would operate on one new dedicated GCL track and share one track with Conrail. On this shared track, GCL trains would operate during the day and evening hours, with Conrail trains operating in the late evening and overnight. The proposed project would provide 14 new transit stations in addition to an existing station at the Walter Rand Transportation Center (WRTC) and two vehicle maintenance facilities. With the proposed project, existing levels of freight operations would be unaffected as the current single freight track would remain undisturbed.

The Glassboro-to-Camden corridor comprises substantial railroad ROW and existing rail infrastructure, which interconnects communities in southern New Jersey. Historically, these communities developed around passenger rail service that once had been available in the Glassboro-to-Camden corridor, but which has not been operating since the 1960s. The GCL would reinstate public transportation among these communities and connect them with the broader, regional public transportation network to allow residents access throughout the corridor and to important regional employment centers.

2 PRINCIPAL CONCLUSIONS

Per the guidance of EPA, detailed analyses of regional criteria pollutants, greenhouse gases, mobile source air toxics, microscale carbon monoxide, and $PM_{2.5}$, as well as train operations, are conducted for the project. Detailed analyses of vehicle maintenance facilities and construction are not warranted, although they are considered and reported qualitatively.

The detailed regional air quality and greenhouse gas analyses resulted in the determination that the project would result in small increases in both criteria pollutants and greenhouse gases. These increases, however, are extremely small and therefore not considered significant impacts.

The detailed mobile source air toxic, microscale carbon monoxide and $PM_{2.5}$ analyses, as well as train operations analysis resulted in the determination that the project would not have any impacts. The project would have a beneficial impact with regards to regional and local traffic operations, as it would reduce regional VMT and improve or have no effect on LOS at most intersections in the project area.

The project could have impacts with regards to the locations of maintenance facilities. Potential impacts at maintenance facilities would not be significant with the implementation of mitigation measures, such as train idling restrictions and the location of spray booths as far away from the public as possible.

The project could also have temporary impacts associated with fugitive dust and mobile-source emissions from construction vehicles and equipment. Potential construction impacts would not be significant with the implementation of mitigation measures, including the minimization of fugitive dust (i.e., watering, covering trucks, and minimizing land disturbance) and avoidance of disruption to traffic during peak travel times.

3 EXISTING CONDITIONS

Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Individual air pollutants degrade the atmosphere by reducing visibility; they are also responsible for damaging property, reducing the productivity or vigor of crops or natural vegetation, and harming human or animal health.

3.1 Clean Air Act Amendments of 1990

The Clean Air Act (CAA) Amendments of 1990 and the Final Transportation Conformity Rule (40 Code of Federal Regulations [CFR] Parts 51 and 93) direct the U.S. Environmental Protection Agency (EPA) to implement environmental policies and regulations that will ensure acceptable levels of air quality.

The CAA and the Final Transportation Conformity Rule affect the funding and approval of proposed transportation projects. According to CAA Title I, Section 176 (c) 2:

> *No federal agency may approve, accept or fund any transportation plan, program or project unless such plan, program or project has been found to conform to any applicable State Implementation Plan (SIP) in effect under this act.*

According to Section 176(c)2(A) of the CAA, conformity to an implementation plan means eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards; and that such activities will not:

- cause or contribute to any new violation of any NAAQS in any area;

- increase the frequency or severity of any existing violation of any NAAQS in any area; or
- delay timely attainment of any NAAQS or any required interim emission reductions or other milestones in any area.

3.2 National and State Ambient Air Quality Standards

As required by the CAA, NAAQS have been established for six major air pollutants. These pollutants, known as criteria pollutants, are carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead.

The federal standards are summarized in Table 1, "National Ambient Air Quality Standards." The "primary" standards have been established to protect public health. The "secondary" standards are intended to protect the nation's welfare, and they account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of general welfare.

Table 1: National Ambient Air Quality Standards

Pollutant		Primary/Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		Carbon Monoxide (CO)	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead (Pb)		Lead (Pb)	Rolling 3 month average	0.15 µg/m^3 [(1)]	Not to be exceeded
Nitrogen Dioxide (NO_2)		Nitrogen Dioxide (NO_2)	1-hour	100 ppb	98th percentile, averaged over 3 years
		Primary and secondary	Annual	53 ppb[(2)]	Annual mean
Ozone (O_3)		Ozone (O_3)	8-hour	0.070 ppm[(3)]	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution	Particle Pollution	Primary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
		Secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
		Primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years

Table 1: National Ambient Air Quality Standards (continued)

Sulfur Dioxide (SO_2)	Sulfur Dioxide (SO_2)	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect.

(2) The level of the annual NO2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. In addition, the previous (2008) O_3 standards remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

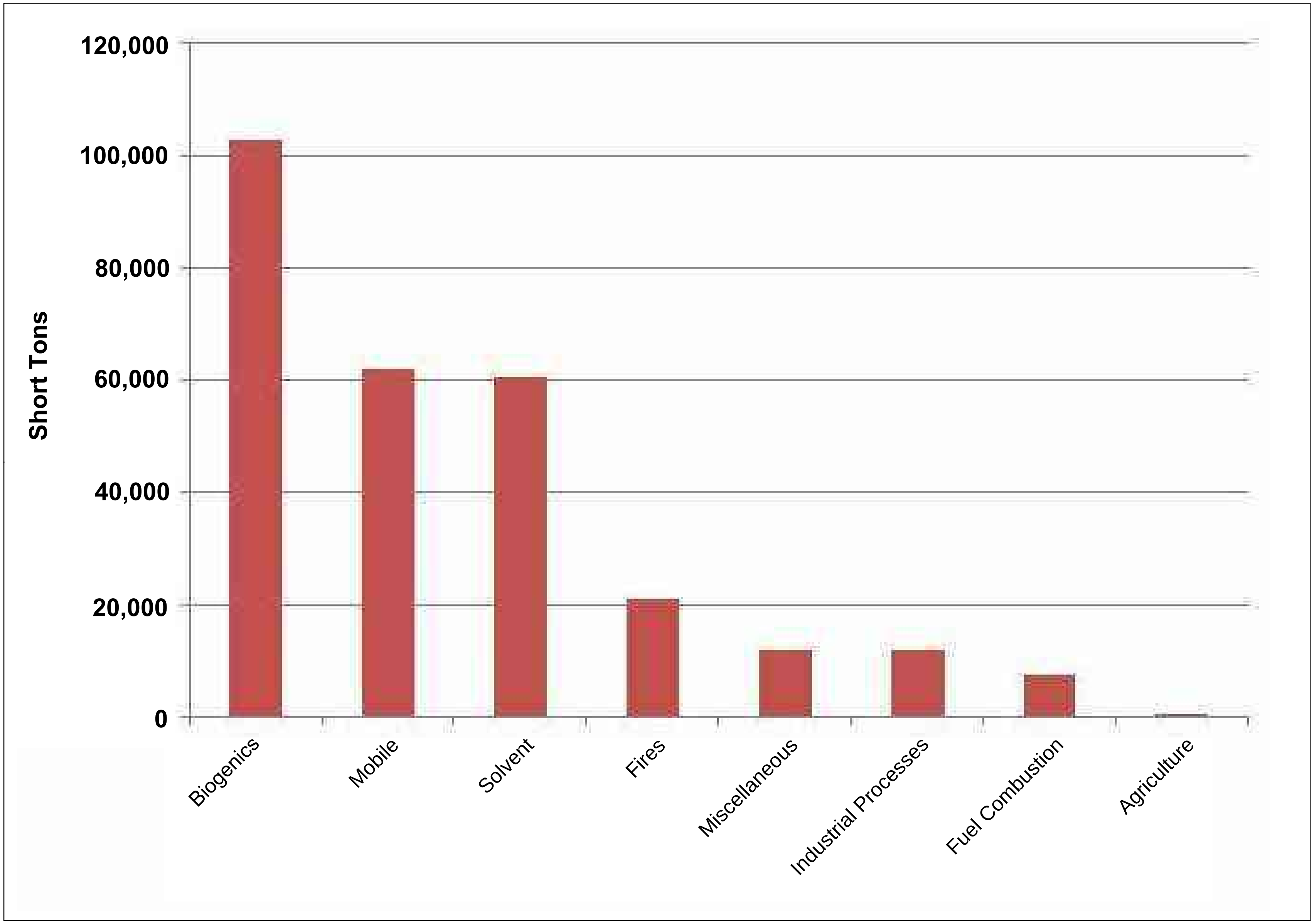
(4) In addition, the previous SO2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO2 standards or is not meeting the requirements of a state implementation plan (SIP) call under the previous SO2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its SIP to demonstrate attainment of the required NAAQS. ppm = parts per million; ppb = parts per billion; µg/m^3 = micrograms per cubic meter

Source: U.S. Environmental Protection Agency, https://www.epa.gov/criteria-air-pollutants/naaqs-table

3.3 Criteria Pollutants and Effects

As previously discussed, pollutants that have established national standards are referred to as “criteria pollutants.” The sources of these pollutants, their effects on human health and the nation’s welfare, and their final deposition in the atmosphere vary considerably. A brief description of each pollutant is given below.

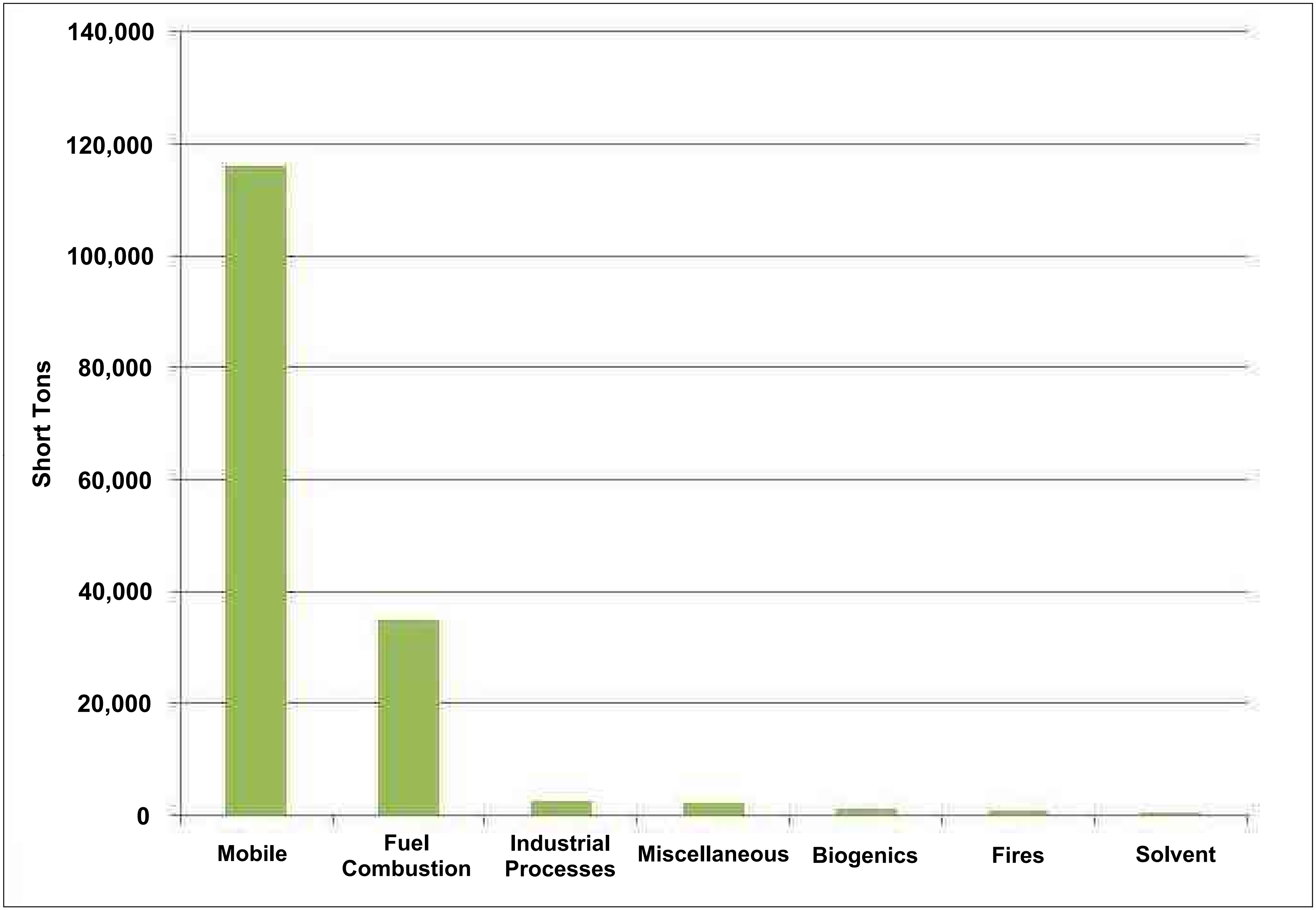
Ozone. Ozone (O_3) is a colorless toxic gas. O_3 is found in both the Earth’s upper and lower atmospheric levels. In the upper atmosphere, O_3 is a naturally occurring gas that helps to prevent the sun’s harmful ultraviolet rays from reaching the Earth. In the lower layer of the atmosphere, the formation of O_3 is mostly the result of human activity, although O_3 also occurs because of hydrocarbons released by plants and soil. O_3 is not directly emitted into the atmosphere; it forms in the lower atmosphere through a chemical reaction between hydrocarbons (HC), also referred to as Volatile Organic Compounds (VOCs), and nitrogen oxides (NOx), which are emitted from industrial sources and from automobiles. As shown on Figure 1, “Sources of VOCs – New Jersey (2014)”and Figure 2, “Sources of NO_X – New Jersey (2014),” biogenics (natural sources) are the primary source of VOCs and mobile sources are the primary sources of NO_X in New Jersey. Substantial O_3 formations generally require a stable atmosphere with strong sunlight; thus, high levels of O_3 are generally a concern in the summer. O_3 is the main ingredient of smog. O_3 enters the bloodstream through the respiratory system and interferes with the transfer of oxygen, depriving sensitive tissues in the heart and brain of oxygen. O_3 also damages vegetation by inhibiting its growth.



Source: U.S. EPA; GCL Project Team, 2020.

Figure 1: Sources of VOCs - New Jersey (2014)

GCL GLASSBORO-CAMDEN LINE



Source: U.S. EPA; GCL Project Team, 2020.

Figure 2: Sources of NOx - New Jersey (2014)

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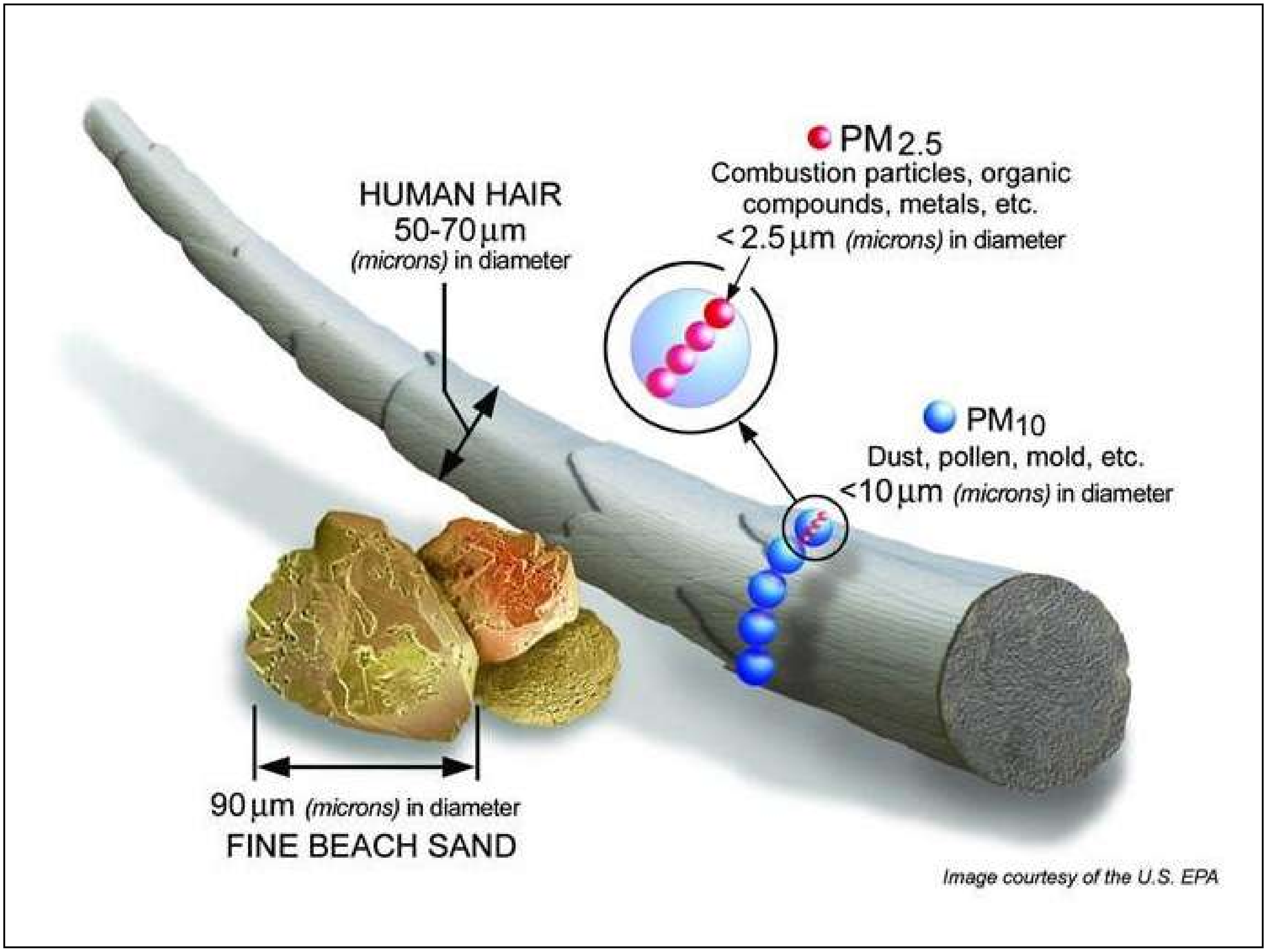
Particulate Matter. Particulate pollution is composed of solid particles or liquid droplets that are small enough to remain suspended in the air. In general, particulate pollution can include dust, soot, and smoke; these can be irritating but usually are not poisonous.

Particulate pollution also can include bits of solid or liquid substances that can be highly toxic. Of particular concern are those particles that are smaller than, or equal to, 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) in size.

PM_{10}. PM_{10} refers to particulate matter less than 10 microns in diameter, about one-seventh the thickness of a human hair (Figure 3, "Relative Particulate Matter Size"). Particulate matter pollution consists of very small liquid and solid particles floating in the air, which can include smoke, soot, dust, salts, acids, and metals. Particulate matter also forms when industry and gases emitted from motor vehicles undergo chemical reactions in the atmosphere. Major sources of PM_{10} include motor vehicles; wood burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions. Suspended particulates produce haze and reduce visibility. In addition, PM_{10} poses a greater health risk than larger- sized particles. When inhaled, these tiny particles can penetrate the human respiratory system's natural defenses and damage the respiratory tract. PM_{10} can increase the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections.



Source: U.S. EPA; GCL Project Team, 2020.

Figure 3: Relative Particulate Matter Size

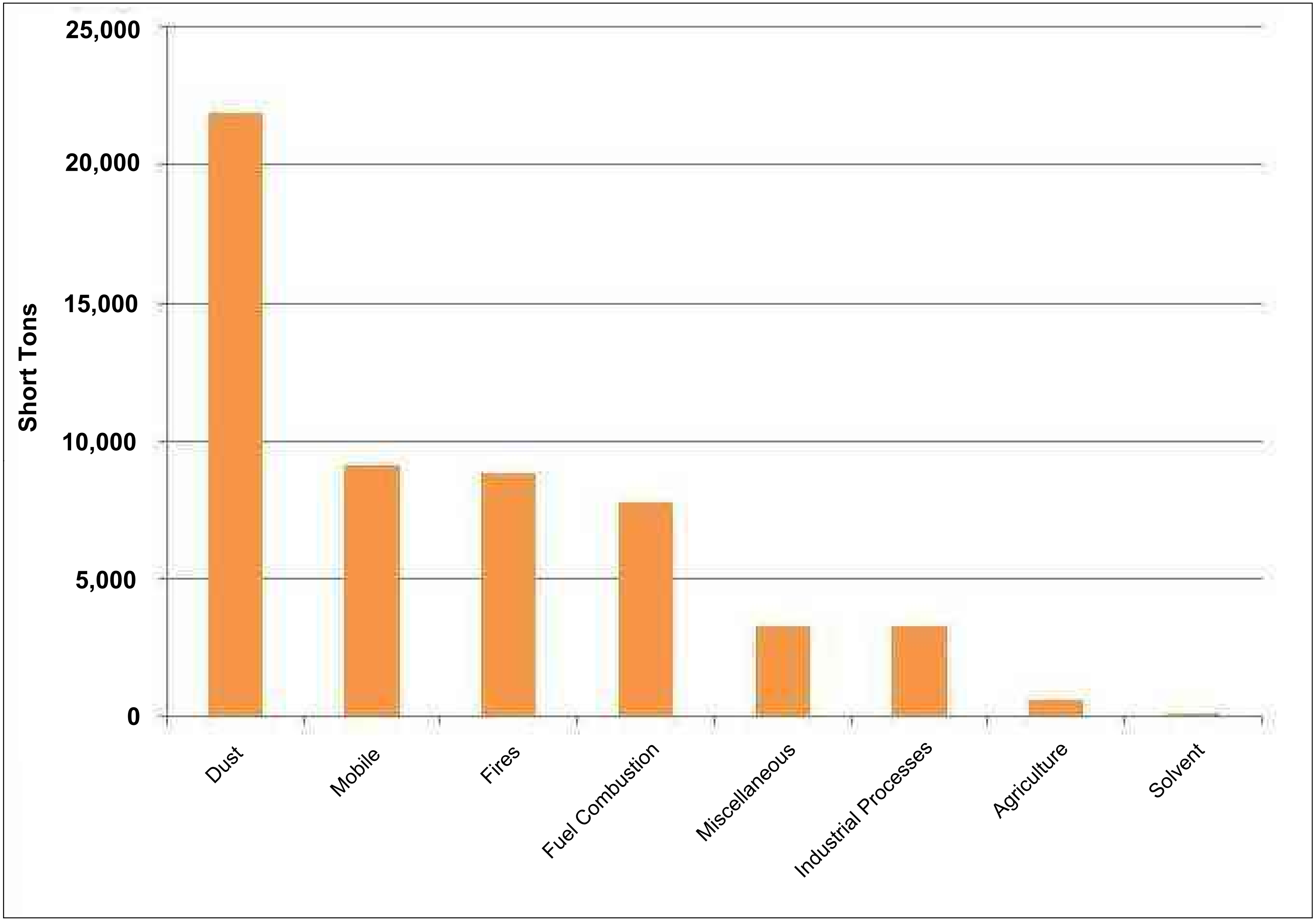
GLASSBORO-CAMDEN LINE

Data collected through numerous nationwide studies indicates that most of the PM_{10} comes from the following:

- Fugitive dust
- Wind erosion
- Agricultural and forestry sources

Figure 4, "Sources of PM_{10} – New Jersey (2014)," shows the primary sources of PM_{10} in New Jersey.

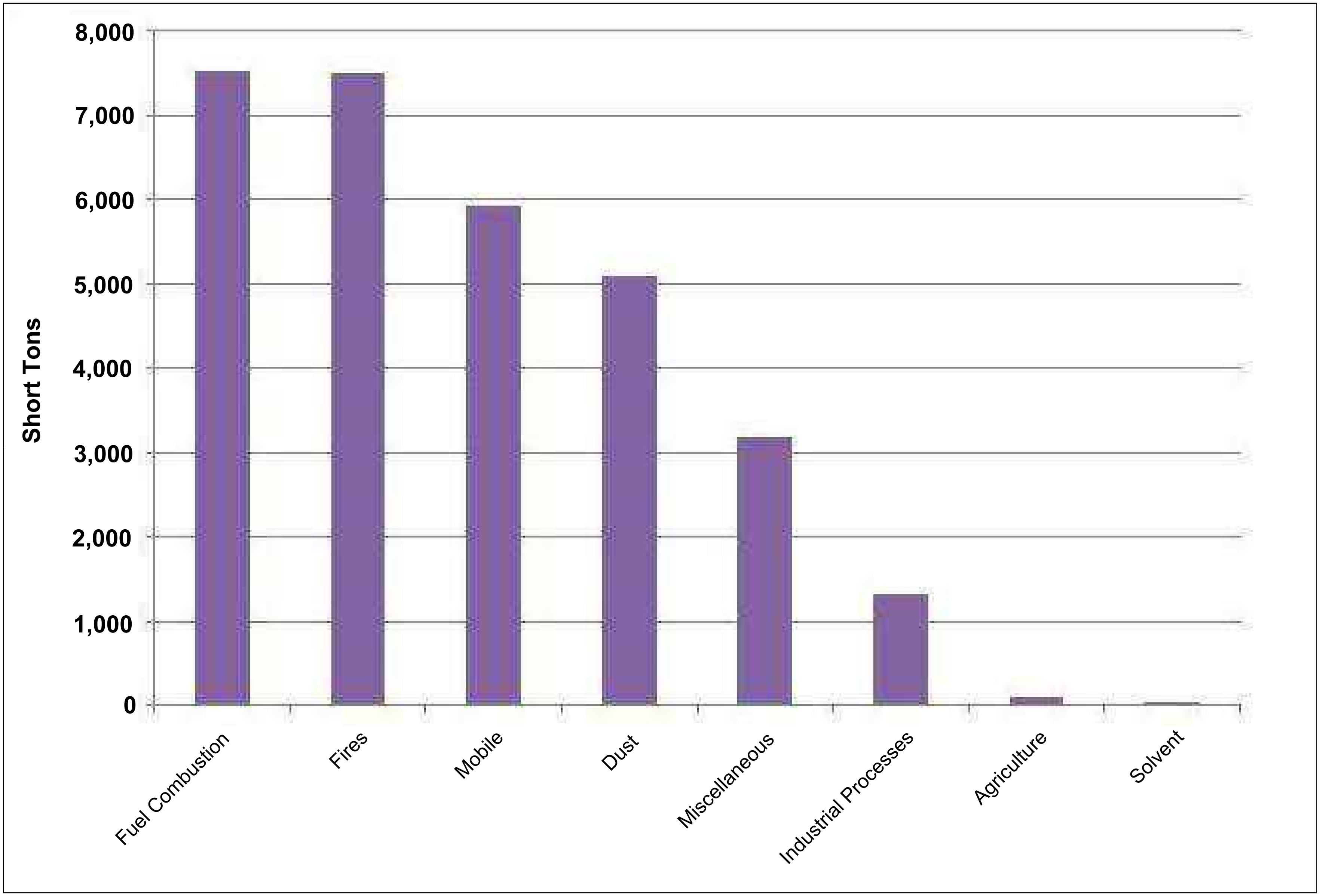
$PM_{2.5}$. A small portion of particulate matter is the product of fuel combustion processes. In the case of $PM_{2.5}$, the combustion of fossil fuels accounts for a significant portion of this pollutant. Figure 5, "Sources of $PM_{2.5}$ – New Jersey (2014)," shows the primary sources of $PM_{2.5}$ in New Jersey. The main health effect of airborne particulate matter is on the respiratory system. $PM_{2.5}$ refers to particulates that are 2.5 microns or less in diameter, roughly 1/28 the diameter of a human hair. $PM_{2.5}$ results from fuel combustion (from motor vehicles, power generation, and industrial facilities), residential fireplaces, and wood stoves. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds. Like PM_{10}, $PM_{2.5}$ can penetrate the human respiratory system's natural defenses and damage the respiratory tract when inhaled. Whereas particles 2.5 to 10 microns in diameter tend to collect in the upper portion of the respiratory system, particles 2.5 microns or less are so tiny that they can penetrate deeper into the lungs and damage lung tissues.



Source: U.S. EPA; GCL Project Team, 2020.

Figure 4: Sources of PM_{10} - New Jersey (2014)

GLASSBORO-CAMDEN LINE



Source: U.S. EPA; GCL Project Team, 2020.

Figure 5: Sources of $PM_{2.5}$ - New Jersey (2014)

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Carbon Monoxide. CO, a colorless gas, interferes with the transfer of oxygen to the brain. CO is emitted almost exclusively from the incomplete combustion of fossil fuels. As shown on Figure 6, “Sources of CO – New Jersey (2014),” mobile sources are the primary sources of CO in New Jersey. Prolonged exposure to high levels of CO can cause headaches, drowsiness, loss of equilibrium, or heart disease. CO concentrations can vary greatly over relatively short distances. Relatively high concentrations of CO are typically found near congested intersections, along heavily used roadways carrying slow-moving traffic, and in areas where atmospheric dispersion is inhibited by urban “street canyon” conditions. Consequently, CO concentrations must be predicted on a localized, or microscale, basis.

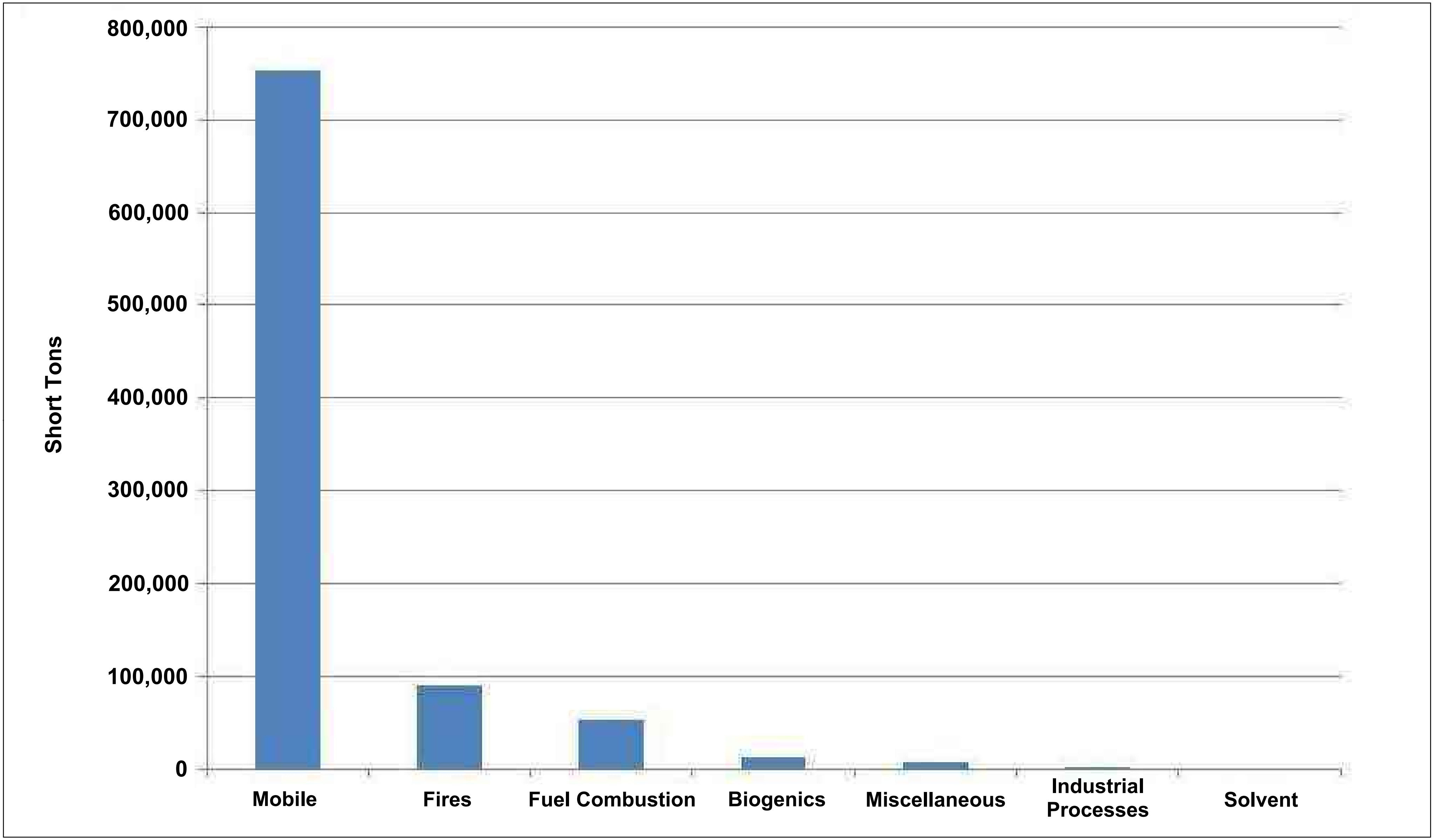

Figure 6: Sources of CO - New Jersey (2014)

Source: U.S. EPA; GCL Project Team, 2020.

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Nitrogen Dioxide. NO_2, a brownish gas, irritates the lungs. It can cause breathing difficulties at high concentrations. Like O_3, NO_2 is not directly emitted, but is formed through a reaction between nitric oxide (NO) and atmospheric oxygen. NO and NO_2 are collectively referred to as nitrogen oxides (NO_x) and are major contributors to ozone formation. NO_2 also contributes to the formation of PM_{10}, small liquid and solid particles that are less than 10 microns in diameter (see discussion of PM_{10} below). At atmospheric concentration, NO_2 is only potentially irritating. In high concentrations, the result is a brownish-red cast to the atmosphere and reduced visibility. There is some indication of a relationship between NO_2 and chronic pulmonary fibrosis. Some increase in bronchitis in children (two and three years old) has also been observed at concentrations below 0.3 parts per million (ppm).

Lead. Pb is a stable element that persists and accumulates both in the environment and in animals. Its principal effects in humans are on the blood-forming, nervous, and renal systems. Lead levels in the urban environment from mobile sources have significantly decreased due to the federally mandated switch to lead-free gasoline.

Sulfur Dioxide. SO_2 is a product of high-sulfur fuel combustion. The main sources of SO_2 are coal and oil used in power stations, industry and for domestic heating. Industrial chemical manufacturing is another source of SO_2. SO_2 is an irritant gas that attacks the throat and lungs. It can cause acute respiratory symptoms and diminished ventilator function in children. SO_2 can also yellow plant leaves and erode iron and steel.

3.4 Mobile Source Air Toxics

In addition to the criteria pollutants for which there are NAAQS, the EPA also regulates air toxics. Toxic air pollutants are those pollutants known or suspected to cause cancer or other serious health effects. Most air toxics originate from human-made sources, including on-road mobile sources, non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries).

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments (CAAA) of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants. The EPA has assessed this expansive list in their latest rule on the Control of Hazardous Air Pollutants from Mobile Sources (*Federal Register*, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/iris/). In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 2011 National Air Toxics Assessment (https://www.epa.gov/national-air-toxics-assessment). These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. While the Federal Highway Administration (FHWA) considers these the priority mobile source air toxics (MSAT), the list is subject to change and may be adjusted in consideration of future EPA rules.

The 2007 EPA rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. FHWA, using EPA's MOVES2014a model, estimates a combined reduction of 91 percent in the total annual emissions for the priority MSATs even as vehicle miles traveled (VMT) increases, as forecast, by 45 percent from 2010 to 2050.

A brief description of the nine priority MSATs is given below.

1,3-Butadiene is a colorless gas with a mild gasoline-like odor. Sources of 1,3-butadiene released into the air include motor vehicle exhaust, manufacturing and processing facilities, forest fires or other combustion, and cigarette smoke. Acute exposure to 1,3-butadiene by inhalation in humans results in irritation of the eyes, nasal passages, throat, and lungs. Neurological effects, such as blurred vision, fatigue, headache, and vertigo, have also been reported at very high exposure levels. One epidemiological study reported that chronic exposure to 1,3-butadiene via inhalation resulted in an increase in cardiovascular diseases, such as rheumatic and arteriosclerotic heart diseases, while other human studies have reported effects on the blood. No information is available on reproductive or developmental effects of 1,3-butadiene in humans. The EPA has classified 1,3-butadiene as a probable human carcinogen by inhalation.

Acetaldehyde is mainly used as an intermediate in the synthesis of other chemicals. It is ubiquitous in the environment and may be formed in the body from the breakdown of ethanol. Acute (short-term) exposure to acetaldehyde results in effects including irritation of the eyes, skin, and respiratory tract. Symptoms of chronic (long-term) intoxication of acetaldehyde resemble those of alcoholism. Acetaldehyde is considered a probable human carcinogen based on inadequate human cancer studies and animal studies that have shown nasal tumors in rats and laryngeal tumors in hamsters.

Acrolein is a water-white or yellow liquid that burns easily, is readily volatilized, and has a disagreeable odor. It is present as a product of incomplete combustion in the exhausts of stationary equipment (e.g., boilers and heaters) and mobile sources. It is also a secondary pollutant, formed through the photochemical reaction of VOC and NO_X in the atmosphere. Acrolein is considered to have high acute toxicity, and it causes upper respiratory tract irritation and congestion in humans. The major effects from chronic (long-term) inhalation exposure to acrolein in humans consist of general respiratory congestion and eye, nose, and throat irritation. No information is available on the reproductive, developmental, or carcinogenic effects of acrolein in humans. EPA considers acrolein data to be inadequate for an assessment of human carcinogenic potential.

Benzene is a volatile, colorless, highly flammable liquid with a sweet odor. Most of the benzene in ambient air is from incomplete combustion of fossil fuels and evaporation from gasoline service stations. Acute inhalation exposure to benzene causes neurological symptoms, such as drowsiness, dizziness, headaches, and unconsciousness in humans. Chronic inhalation of certain levels of benzene causes disorders in the blood in humans. Benzene specifically affects bone marrow (the tissues that produce blood cells). Aplastic anemia, excessive bleeding, and damage to the immune system (by changes in blood levels of antibodies and loss of white blood cells) may develop. Available human data on the developmental effects of benzene are inconclusive due to concomitant exposure to other chemicals, inadequate sample size, and lack of quantitative exposure data. The EPA has classified benzene as a known human carcinogen by inhalation.

Diesel Particulate Matter (DPM)/Diesel Exhaust Organic Gases are a complex mixture of hundreds of constituents in either a gaseous or particle form. Gaseous components of diesel exhaust (DE) include carbon dioxide (CO_2), oxygen, nitrogen, water vapor, CO, nitrogen compounds, sulfur compounds, and numerous low-molecular-weight hydrocarbons. Among the gaseous hydrocarbon components of DE that are individually known to be of toxicological relevance are several carbonyls (e.g., formaldehyde, acetaldehyde, acrolein), benzene, 1,3-butadiene, and polycyclic aromatic hydrocarbons (PAHs) and nitro-PAHs. Diesel particulate matter is composed of a center core of elemental carbon and adsorbed organic compounds, as well as small amounts of sulfate, nitrate, metals, and other trace elements. It consists primarily of $PM_{2.5}$, including a subgroup with a large number of particles having a diameter <0.1 µm. Collectively, these particles have a large surface area, which makes them an excellent medium for adsorbing organics. Also, their small size makes them highly respirable and able to reach the deep lung. A number of potentially toxicologically-relevant organic compounds, including PAHs, nitro-PAHs, and oxidized PAH derivatives, are on the particles. Diesel exhaust is emitted from on-road mobile sources, such as automobiles and trucks, and from off-road mobile sources (e.g., diesel locomotives, marine vessels, and construction equipment). Diesel particulate matter is directly emitted from diesel-powered engines (primary particulate matter) and can be formed from the gaseous compounds emitted by diesel engines (secondary particulate matter).

Acute or short-term (e.g., episodic) exposure to DE can cause acute irritation (e.g., eye, throat, bronchial), neurophysiological symptoms (e.g., lightheadedness, nausea), and respiratory symptoms (cough, phlegm). Evidence also exists for an exacerbation of allergenic responses to known allergens and asthma-like symptoms. Information from the available human studies is inadequate for a definitive evaluation of possible non-cancer health effects from chronic exposure to DE. However, on the basis of extensive animal evidence, DE is judged to pose a chronic respiratory hazard to humans. The EPA has determined that DE is "likely to be carcinogenic to humans by inhalation" and that this hazard applies to environmental exposures.

Ethylbenzene is mainly used in the manufacture of styrene. Acute (short-term) exposure to ethylbenzene in humans results in respiratory effects, such as throat irritation and chest constriction, irritation of the eyes, and neurological effects such as dizziness. Chronic (long-term) exposure to ethylbenzene by inhalation in humans has shown conflicting results regarding its effects on the blood. Animal studies have reported effects on the blood, liver, and kidneys from chronic inhalation exposure to ethylbenzene. Limited information is available on the carcinogenic effects of ethylbenzene in humans. In a study by the National Toxicology Program, exposure to ethylbenzene by inhalation resulted in an increased incidence of kidney and testicular tumors in rats, and lung and liver tumors in mice.

Formaldehyde is a colorless gas with a pungent, suffocating odor at room temperature. The major emission sources of formaldehyde appear to be power plants, manufacturing facilities, incinerators, and automobile exhaust. However, most of the formaldehyde in ambient air is a result of secondary formation through photochemical reaction of VOC and NOX. The major toxic effects caused by acute formaldehyde exposure via inhalation are eye, nose, and throat irritation and effects on the nasal cavity. Other effects seen from exposure to high levels of formaldehyde in humans are coughing, wheezing, chest pains, and bronchitis. Chronic exposure to formaldehyde by inhalation in humans has been associated with respiratory symptoms and eye, nose, and throat irritation. The EPA considers formaldehyde to be a probable human carcinogen.

Naphthalene is used in the production of phthalic anhydride; it is also used in mothballs. Acute (short-term) exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with hemolytic anemia, damage to the liver, and neurological damage. Cataracts have also been reported in workers acutely exposed to naphthalene by inhalation and ingestion. Chronic (long-term) exposure of workers and rodents to naphthalene has been reported to cause cataracts and damage to the retina. Hemolytic anemia has been reported in infants born to mothers who “sniffed” and ingested naphthalene (as mothballs) during pregnancy. Available data are inadequate to establish a causal relationship between exposure to naphthalene and cancer in humans. The EPA has classified naphthalene as a Group C, possible human carcinogen.

The term **polycyclic organic matter (POM)** defines a broad class of compounds that includes the polycyclic aromatic hydrocarbon compounds (PAH), of which benzo[a]pyrene is a member. POM compounds are formed primarily from combustion and are present in the atmosphere in particulate form. Sources of air emissions are diverse and include cigarette smoke, vehicle exhaust, home heating, laying tar, and grilling meat. Cancer is the major concern from exposure to POM. Epidemiologic studies have reported an increase in lung cancer in humans exposed to coke oven emissions, roofing tar emissions, and cigarette smoke; all of these mixtures contain POM compounds. Animal studies have reported respiratory tract tumors from inhalation exposure to benzo[a]pyrene and forestomach tumors, leukemia, and lung tumors from oral exposure to benzo[a]pyrene. The EPA has classified seven PAHs (benzo[a]pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) as Group B2, probable human carcinogens.

3.5 Climate Change and Greenhouse Gases

Climate change is an important national and global concern. While the Earth has gone through many natural changes in climate in its history, there is general agreement that the Earth’s climate is currently changing at an accelerated rate and will continue to do so for the foreseeable future. Anthropogenic (human-caused) greenhouse gas (GHG) emissions contribute to this rapid change. Carbon dioxide (CO_2) makes up the largest component of these GHG emissions. Other prominent transportation GHGs include methane (CH_4) and nitrous oxide (N_2O).

Many GHGs occur naturally. Water vapor is the most abundant GHG and makes up approximately two thirds of the natural greenhouse effect. However, the burning of fossil fuels and other human activities are adding to the concentration of GHGs in the atmosphere. Many GHGs remain in the atmosphere for time periods ranging from decades to centuries. GHGs trap heat in the Earth’s atmosphere. Because atmospheric concentration of GHGs continues to climb, our planet will continue to experience climate-related phenomena. For example, warmer global temperatures can cause changes in precipitation and sea levels.

To date, no national standards have been established regarding GHGs, nor has the EPA established criteria or thresholds for ambient GHG emissions pursuant to its authority to establish motor vehicle emission standards for CO_2 under the CAA. However, there is a considerable body of scientific literature addressing the sources of GHG emissions and their adverse effects on climate, including reports from the Intergovernmental Panel on Climate Change, the U.S. National Academy of Sciences, and the EPA and other federal agencies. Greenhouse gases are different from other air pollutants evaluated in federal environmental reviews because their impacts are not localized or regional due to their rapid dispersion into the global atmosphere, which is characteristic of these gases. The *affected environment* for CO_2 and other GHG emissions is the entire planet. In addition, from a quantitative perspective, global climate change is the cumulative result of numerous and varied emissions sources (in terms of both absolute numbers and types), each of which makes a relatively small addition to global atmospheric GHG concentrations. In contrast to broad scale actions, such as actions involving an entire industry sector or large geographic areas, it is difficult to isolate and understand the GHG emissions impacts for a particular transportation project. Further, presently there is no scientific methodology for attributing specific climatological changes to a particular transportation project's emissions.

3.6 Attainment Status/Regional Air Quality Conformity

Section 107 of the 1977 CAAA requires that the EPA publish a list of all geographic areas in compliance with the NAAQS, plus those not attaining the NAAQS. Areas not in NAAQS compliance are deemed nonattainment areas. Areas that have insufficient data to make a determination are deemed unclassified, and are treated as being attainment areas until proven otherwise. Maintenance areas are areas that were previously designated as nonattainment for a particular pollutant, but have since demonstrated compliance with the NAAQS for that pollutant. An area's designation is based on the data collected by the state monitoring network on a pollutant-by-pollutant basis.

The project study corridor encompasses both Camden and Gloucester counties. Table 2, "Project Area Attainment Status," shows the attainment status for those portions of the counties in which the project is located. As shown in the table, both counties are classified as maintenance areas for $PM_{2.5}$ (24-hour standard) and nonattainment for O_3. The project is currently included in the DVRPC FY 2018-2021 TIP as the Second Phase of River LINE LRT/PATCO Extension, under Transit Rail Initiatives, DB# T300.

Table 2: Project Area Attainment Status

Pollutant	Camden County	Gloucester County
Ozone (O_3)	Nonattainment	Nonattainment
Nitrogen Dioxide (NO_2)	Attainment	Attainment
Carbon Monoxide (CO)	Attainment	Attainment
Particulate Matter (PM_{10})	Attainment	Attainment
Particulate Matter ($PM_{2.5}$) Annual/24-Hour	Attainment/Maintenance	Attainment/Maintenance
Lead (Pb)	Attainment	Attainment

Source: U.S. Environmental Protection Agency, 2018

Camden and Gloucester counties are part of the Delaware Valley Regional Planning Commission (DVRPC). The DVRPC is the federally designated metropolitan planning organization for the greater Philadelphia region. The DVRPC represents nine counties: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey. As the metropolitan planning organization, the DVRPC is directly responsible for making sure that any money spent on existing and future transportation projects and programs is based on a continuing, cooperative, and comprehensive planning process. All transportation projects in the Philadelphia region that receive federal funding, such as the Glassboro-Camden Line project, go through this planning process.

The DVRPC provides policy direction and oversight in the development of a federally mandated *Transportation Improvement Program* (TIP), the *Long Range Transportation Plan* (LRTP) and the transportation element of the *State Air Quality Implementation Plan* (SIP).

The TIP is financially constrained over five years covering the most immediate implementation priorities for surface transportation projects and strategies from the LRTP. The TIP includes all state and local projects that request federal dollars to implement (those projects have a state or local dollar match). The DVRPC FY2016 TIP for New Jersey (FY 2016-2019) was adopted by the DVRPC Board on September 30, 2015 and became effective on November 20, 2015. The project is currently included in the DVRPC TIP as the Second Phase of River LINE LRT/PATCO Extension, under Transit Rail Initiatives, DB# T300.

The LRTP guides transportation system improvements for southeastern Pennsylvania and southern New Jersey. It serves as a blueprint for long and short range strategies and actions for developing an integrated intermodal transportation system to facilitate the efficient movement of people and goods. The area's LRTP—*Connections 2045 Long-Range Plan for Greater Philadelphia*—was approved by the DVRPC on October 26, 2017. The project is currently included in the LRTP.

In December 2012, the New Jersey Department of Environment Protection submitted a Maintenance Plan SIP to demonstrate attainment for both the Annual and 24-Hour $PM_{2.5}$ standards. The Maintenance Plan was found adequate for conformity purposes by the EPA in May 2013, and the final approval of that finding became effective in July 2013 (78 FR 37717).

3.7 Climate Description and Ambient Air Quality in the Study Area

New Jersey has five distinct climate zones/regions. The geology, distance from the Atlantic Ocean, and prevailing atmospheric flow patterns produce distinct variations in the daily weather between each of the zones. These five zones include Northern, Central, Pine Barrens, Southwest and Coastal.

The proposed project is within the Southwest Zone. The Southwest Zone lies between sea level and approximately 100 feet above sea level. The close proximity to Delaware Bay adds a maritime influence to the climate of this region. The Southwest region has the highest average daily temperatures in the state and, without sandy soils, tends to have higher nighttime minimum temperatures than in the neighboring Pine Barrens. This region receives less precipitation than the Northern and Central regions of the state, as there are no orographic features, and it is farther away from the Great Lakes-St. Lawrence storm track. It is also far enough inland to be away from the heavier rains from some coastal storms, thus it receives less precipitation than the Coastal Zone.

Prevailing winds are from the southwest, except in winter when west to northwest winds dominate. High humidity and moderate temperatures prevail when winds flow from the south or east. The moderating effect of the water also allows for a longer growing season. Autumn frosts usually occur about four weeks later than in the North and the last spring frosts are about four weeks earlier, giving this region the longest growing season in New Jersey (Office of New Jersey State Climatologist, Rutgers University).

New Jersey Department of Environment Protection maintains a series of monitors throughout the state to measure ambient air quality levels. Monitors near and within the project's study area are shown on Figure 7, "Air Monitoring Locations." The air quality data collected at these monitors for the years 2014-2016 is presented in Table 3, "Ambient Air Quality Monitoring Data 2014-2016." As shown in Table 3, "Ambient Air Quality Monitoring Data 2014-2016," all pollutants monitored, with the exception of O_3, are below the applicable NAAQS.

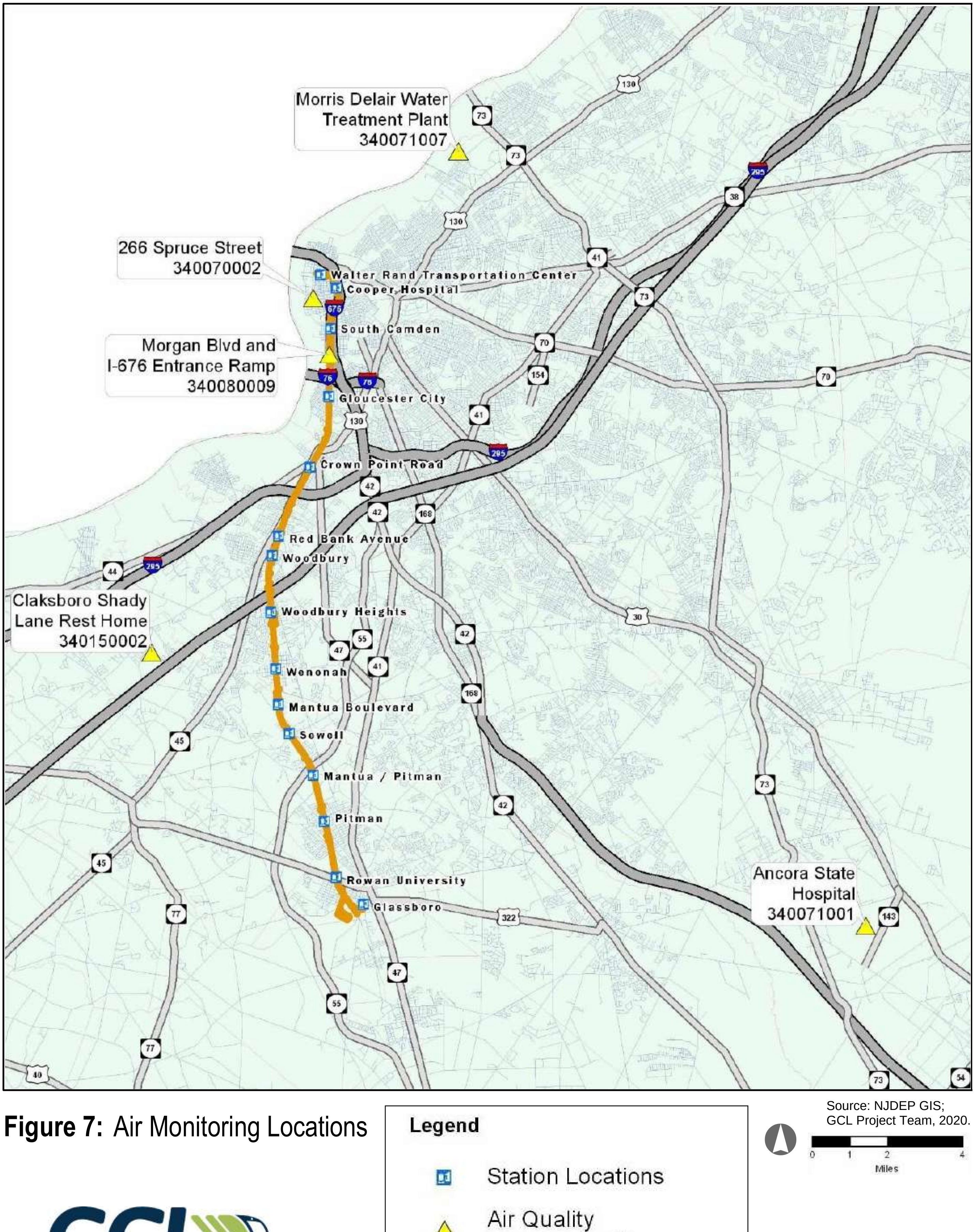

Figure 7: Air Monitoring Locations

GLASSBORO-CAMDEN LINE

Table 3: Ambient Air Quality Monitoring Data 2014-2016

			266 Spruce Street Camden County Site ID 340070002			Ancora State Hospital 202 Spring Garden Road Camden County Site ID 340071001			Clarksboro Shady Rest Home Shady Lane and County House Road Gloucester County Site ID 340150002			Morgan Boulevard and I-676 Entrance Ramp Camden County Site ID 340080009			Morris Delair Water Treatment Plant Camden County Site ID 340071007		
			2014	**2015**	**2016**	**2014**	**2015**	**2016**	**2014**	**2015**	**2016**	**2014**	**2015**	**2016**	**2014**	**2015**	**2016**
Carbon Monoxide (CO) [ppm]	**1-Hour**	Maximum	1.8	2.0	1.8												
		2nd Maximum	1.7	1.9	1.7												
		# of Exceedences	0	0	0												
	8-Hour	Maximum	1.5	1.7	1.5												
		2nd Maximum	1.3	1.5	1.3												
		# of Exceedences	0	0	0												
Particulate Matter [ug/m³]	PM_{10}	Maximum 24-Hour										97	114	127			
		Second Maximum										57	110	113			
		# of Exceedences										0	0	0			
	$PM_{2.}$	24-Hour 98th Percentile	22	26	24										24	22	17
		Mean Annual	10.6	10.2	9.4										9.4	9.0	8.1
Ozone (O_3) [ppm]	**8-Hour**	First Highest	0.075	0.090	0.081	0.076	0.076	0.076	0.077	0.080	0.083						
		Second Highest	0.074	0.083	0.078	0.073	0.076	0.076	0.075	0.079	0.079						
		Third Highest	0.068	0.081	0.078	0.069	0.075	0.069	0.071	0.077	0.077						
		Fourth Highest	0.068	0.079	0.078	0.068	0.072	0.069	0.070	0.076	0.076						
		# of Days Standard Exceeded	2	11	9	2	7	2	3	5	7						
Nitrogen Dioxide (NO_2) [ppb]		1-Hour 98th Percentile	50	51	52												
		Annual Mean	18.51	13.57	12.24												
Sulfur Dioxode (SO_2) [ppb]		1-Hour 99th Percentile	10	16	11												

Source: U.S. Environmental Protection Agency Office of Air Quality Planning and Standards (AIRData); https://www.epa.gov/outdoor-air-quality-data

4 ENVIRONMENTAL CONSEQUENCES

4.1 Sources of Emissions

Pollutants that can be traced principally to motor vehicles are relevant to the evaluation of the project’s impacts. These pollutants include CO, HC, NO_X, O_3, PM_{10}, $PM_{2.5}$, and MSATs. Transportation sources account for a small percentage of regional emissions of SO_x and Pb; thus, a detailed analysis of these pollutants is not required.

HC (VOC) and NO_x emissions from automotive sources are a concern primarily because they are precursors in the formation of ozone and particulate matter. Ozone is formed through a series of reactions that occur in the atmosphere in the presence of sunlight. Because the reactions are slow and occur as the pollutants are diffusing downwind, elevated ozone levels often are found many miles from the sources of the precursor pollutants. Therefore, the effects of HC and NO_x emissions generally are examined on a regional or “mesoscale” basis.

PM_{10} and $PM_{2.5}$ impacts are both regional and local. A large portion of particulate matter, especially PM_{10}, comes from disturbed vacant land, construction activity, and paved road dust. $PM_{2.5}$ also comes from these sources. Motor vehicle exhaust, particularly from diesel vehicles, is also a source of PM_{10} and $PM_{2.5}$. PM_{10}, and especially $PM_{2.5}$, can also be created by secondary formation from precursor elements such as sulfur dioxide (SO_2), nitrogen oxides (NO_X), volatile organic compounds (VOCs), and ammonia (NH_3). Secondary formation occurs because of chemical reaction in the atmosphere generally downwind some distance from the original emission source. Thus, it is appropriate to predict concentrations of PM_{10} and $PM_{2.5}$ on both a regional and a localized basis.

CO impacts are generally localized. Even under the worst meteorological conditions and most congested traffic conditions, high concentrations are limited to a relatively short distance (300 to 600 feet) of heavily traveled roadways. Vehicle emissions are the major sources of CO. The project could change traffic patterns within the project study corridor. Consequently, it is appropriate to predict concentrations of CO on both a regional and a localized or “microscale” basis.

MSAT impacts are both regional and local. Through the issuance of the EPA’s Control of Emissions of Hazardous Air Pollutants from Mobile Sources (66 Federal Register 17229), it was determined that many existing and newly promulgated mobile source emission control programs would result in a reduction of MSATs. The EPA examined the impacts of existing and newly promulgated mobile source control programs, including its reformulated gasoline program, its national low emission vehicle standards, its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements, and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel requirements. Future emissions likely would be lower than present levels as a result of the EPA’s national control programs that are projected to reduce MSAT emission by 91 percent from 2010 to 2050, even if VMT increases by 45 percent.

4.2 Regional Analysis

A regional, or mesoscale, analysis of a project determines a project's overall impact on regional air quality levels. A regional analysis was performed for the project using the EPA's Motor Vehicle Emission Simulator (MOVES) emissions program, MOVES2014a to determine roadway emissions and project specific emission rates for the Stadler light diesel multiple units (DMU), 450 kw engine, the proposed transit engine for the project. MOVES2014a incorporates project-generated VMT as well as specific MOVES input factors, such as inspection and maintenance programs, fleet mix, and speed profiles, for the traffic network being analyzed. MOVES input factors were obtained from the DVRPC for both Camden and Gloucester counties.

The emission burden analysis of a project determines the daily "pollutant burden" levels for the No-Action Condition and the proposed GCL, as well as the No-Action Alternative, in order to provide a basis of comparison for regional emissions of each of the criteria pollutants under the GCL. The emission burdens (in metric tons) for the GCL, as well as the No-Action Alternative, are presented in Table 4, "2040 Daily Weekday Regional Emission Burden Assessment (Metric Tons)."

Table 4: 2040 Daily Weekday Regional Emission Burden Assessment (Metric Tons)

Alternative	Hydrocarbons (HC)	Nitrogen Oxides (NOx)	Carbon Monoxide (CO)	Particulate Matter (PM_{10})	Particulate Matter ($PM_{2.5}$)
No-Action	0.042	0.244	1.79	0.01	0.01
The GCL	0.046	0.249	1.84	0.01	0.01
Note: Emission Burdens have been rounded					

Source: MOVES2014a emission factors input files, DVRPC, MOVES emission factor program Environmental Protection Agency, 2018

As shown in Table 4, "2040 Daily Weekday Regional Emission Burden Assessment (Metric Tons)," the GCL is predicted to slightly increase regional pollutant burdens as compared to the No-Action Alternative.

4.3 Mobile Source Air Toxics Analysis

The EPA is the lead federal agency for administering the CAA and has certain responsibilities regarding the health effects of MSATs. The EPA issued a final rule on Control of Emissions of Hazardous Air Pollutants from Mobile Sources (66 *Federal Register* 17229, March 29, 2001). This rule was issued under the authority in Section 202 of the CAA. In its rule, the EPA examined the impacts of existing and newly promulgated mobile source control programs including: its reformulated gasoline program; its national low emission vehicle standards; its Tier 2 motor vehicle emissions standards and gasoline sulfur control requirements; and its proposed heavy duty engine and vehicle standards and on-highway diesel fuel requirements. Future emissions likely would be lower than present levels as result of the EPA's national control programs that are projected to reduce MSAT emission by 91 percent from 2010 to 2050, even if VMT increases by 45 percent (see Figure 8, "National MSAT Emission Trends 2010 – 2050 for Vehicles Operating on Roadways Using EPA's MOVES 2014a Model).

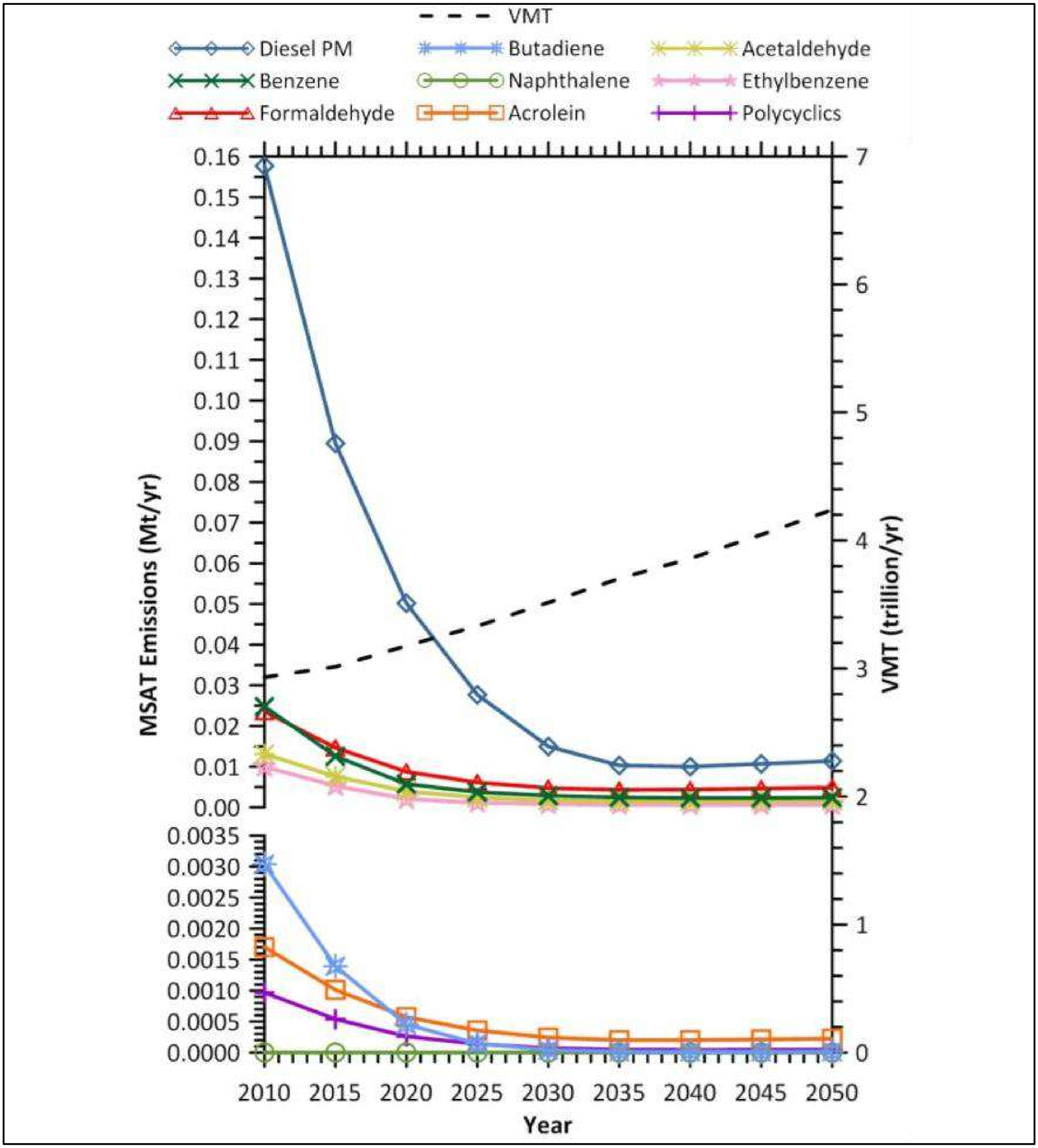

Figure 8: National MSAT Emission Trends 2010-2050 for Vehicles Operating on Roadways Using EPA's MOVES 2014a Model

Source: EPA MOVES2014a model runs conducted by FHWA, September 2016; GCL Project Team, 2020.

GCL
GLASSBORO-CAMDEN LINE

Note: Trends for specific locations may be different, depending on locally derived information representing vehicle-miles traveled, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

On February 9, 2007, and under authority of CAA Section 202(l), the EPA signed a Final Rule - Control of Hazardous Air Pollutants from Mobile Sources (*Federal Register*, Vol. 72, No. 37, page 8,430, February 26, 2007), which sets standards to control MSATs from motor vehicles. Under this rule, the EPA is setting standards on fuel composition, vehicle exhaust emissions, and evaporative losses from portable containers. The new standards are estimated to reduce total emissions of MSATs by 330,000 tons in 2030, including 61,000 tons of benzene. Concurrently, total emissions of VOC will be reduced by over 1.1 million tons in 2030 as a result of adopting these standards.

On February 3, 2006, the FHWA released *Interim Guidance on Air Toxic Analysis in NEPA Documents* (FHWA 2006a). This guidance was superseded on October 18, 2016 by FHWA's *Updated Interim Guidance Update on Air Toxic Analysis in NEPA Documents.*[1] FHWA guidance is being referenced as Federal Transit Administration does not have their own specific guidance regarding MSAT in National Environmental Policy Act (NEPA) documentation. The purpose of FHWA's guidance is to advise on when and how to analyze MSATs in the NEPA environmental review process for highways. This guidance is considered interim because MSAT science is still evolving. As the science progresses, FHWA will update the guidance.

A quantitative analysis provides a basis for identifying and comparing the potential differences among MSAT emissions, if any, from the No-Action Alternative and the proposed GCL. The quantitative assessment presented is derived in part from a study conducted by the FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives*. The FHWA's Interim Guidance groups projects into the following tiered categories:

1. Tier 1: No analysis for projects without potential for meaningful MSAT effects
2. Tier 2: Qualitative analysis for projects with low potential MSAT effects
3. Tier 3: Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects

Based on the FHWA's recommended tiering approach, the Glassboro-Camden project falls within the Tier 2 approach (i.e., for projects with a low potential for MSAT effects). The amount of MSATs emitted would be proportional to the VMT, assuming the vehicle mix does not change. Predicted regional VMT estimates indicate that the GCL would reduce regional VMT by approximately 2 percent. Further, the project would utilize light DMU trainsets, which emit fewer pollutants than the typically used heavy DMU trainsets. As such, the project is predicted to generally produce no meaningful regional MSAT effects.

4.3.1 Information that is Unavailable or Incomplete

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced

[1] https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/

into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. They are the lead authority for administering the Clean Air Act and its amendments and have specific statutory obligations with respect to hazardous air pollutants and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants. They maintain the Integrated Risk Information System (IRIS), which is "a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects."[2] Each report contains assessments of non-cancerous and cancerous effects for individual compounds and quantitative estimates of risk levels from lifetime oral and inhalation exposures with uncertainty spanning perhaps an order of magnitude.

Other organizations are also active in the research and analyses of the human health effects of MSAT, including the Health Effects Institute (HEI). A number of HEI studies are summarized in Appendix D of FHWA's Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Among the adverse health effects linked to MSAT compounds at high exposures are: cancer in humans in occupational settings; cancer in animals; and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is the adverse human health effects of MSAT compounds at current environmental concentrations[3] or in the future as vehicle emissions substantially decrease.

The methodologies for forecasting health impacts include emissions modeling; dispersion modeling; exposure modeling; and then final determination of health impacts – each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives. These difficulties are magnified for lifetime (i.e., 70 year) assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over that time frame, since such information is unavailable.

It is particularly difficult to reliably forecast 70-year lifetime MSAT concentrations and exposure near roadways; to determine the portion of time that people are actually exposed at a specific location; and to establish the extent attributable to a proposed action, especially given that some of the information needed is unavailable.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT, because of factors such as low-dose extrapolation and translation of occupational exposure data

[2] EPA, https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/

[3] HEI Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects

to the general population, a concern expressed by HEI[4]. As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular for diesel PM. The EPA states that with respect to diesel engine exhaust, "[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk." [5]

There is also the lack of a national consensus on an acceptable level of risk. The current context is the process used by the EPA as provided by the Clean Air Act to determine whether more stringent controls are required in order to provide an ample margin of safety to protect public health or to prevent an adverse environmental effect for industrial sources subject to the maximum achievable control technology standards, such as benzene emissions from refineries. The decision framework is a two-step process. The first step requires EPA to determine an "acceptable" level of risk due to emissions from a source, which is generally no greater than approximately 100 in a million. Additional factors are considered in the second step, the goal of which is to maximize the number of people with risks less than 1 in a million due to emissions from a source. The results of this statutory two-step process do not guarantee that cancer risks from exposure to air toxics are less than 1 in a million; in some cases, the residual risk determination could result in maximum individual cancer risks that are as high as approximately 100 in a million. In a June 2008 decision, the U.S. Court of Appeals for the District of Columbia Circuit upheld EPA's approach to addressing risk in its two-step decision framework. Information is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than deemed acceptable.[6]

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities plus improved access for emergency response, that are better suited for quantitative analysis.

4.4 Microscale CO Analysis

The EPA Motor Vehicle Emission Simulator (MOVES2014a) and the CAL3QHC (Version 2.0) air quality dispersion model were used to estimate existing, future No-Action and the future GCL CO levels at selected locations in the project area.

Mobile source models are the basic analytical tools used to estimate CO concentrations expected under given traffic, roadway geometry, and meteorological conditions. The mathematical expressions and

[4] Special Report 16, https://www.healtheffects.org/publication/mobile-source-air-toxics-critical-review-literature-exposure-and-health-effects
[5] EPA IRIS database, Diesel Engine Exhaust, Section II.C. https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0642.htm#quainhal
[6] https://www.cadc.uscourts.gov/internet/opinions.nsf/284E23FFE079CD59852578000050C9DA/$file/07-1053-1120274.pdf

formulations that comprise the various models attempt to describe an extremely complex physical phenomenon as closely as possible. The dispersion modeling program used in this project for estimating pollutant concentrations near roadway intersections is the CAL3QHC (Version 2.0) dispersion model developed by EPA and first released in 1992.

CAL3QHC is a Gaussian model recommended in the EPA's Guidelines for Modeling Carbon Monoxide from Roadway Intersections. Gaussian models assume that the dispersion of pollutants downwind of a pollution source follow a normal distribution from the center of the pollution source.

Different emission rates occur when vehicles are stopped (i.e., idling), accelerating, decelerating, and moving at different average speeds. CAL3QHC simplifies these different emission rates into two components:

- Emissions when vehicles are stopped (i.e., idling) during the red phase of a signalized intersection
- Emissions when vehicles are in motion during the green phase of a signalized intersection

The CAL3QHC (Version 2.0) air quality dispersion model has undergone extensive testing by EPA and has been found to provide reliable estimates of inert (i.e., nonreactive) pollutant concentrations resulting from motor vehicle emissions. A complete description of the model is provided in the User's Guide to CAL3QHC (Version 2.0): *A Modeling Methodology for Predicting Pollutant Concentrations near Roadway Intersections* (Revised 1995).

The transport and concentration of pollutants emitted from motor vehicles are influenced by three principal meteorological factors: wind direction, wind speed, and the atmosphere's profile. The values for these parameters were chosen to maximize pollutant concentrations at each prediction site. That is, to establish a conservative, reasonable worst-case scenario. The following values were used for these parameters:

- **Wind Direction**. Maximum CO concentrations normally are found when the wind is assumed to blow parallel to a roadway adjacent to the receptor location. At complex intersections, it is difficult to predict which wind angle will result in maximum concentrations. Therefore, the approximate wind angle that would result in maximum pollutant concentrations at each receptor location was used in the analysis. All wind angles from 0 to 360 degrees (in 5-degree increments) were considered.
- **Wind Speed**. The CO concentrations are greatest at low wind speeds. A conservative wind speed of one meter per second (2.2 miles per hour) was used to predict CO concentrations during peak traffic periods.
- **Profile of the Atmosphere**. A "mixing" height (the height in the atmosphere to which pollutants rise) of 1,000 meters, and neutral atmospheric stability (stability class D) conditions were used in estimating microscale CO concentrations.

The CO levels estimated by the model are the maximum concentrations which could be expected to occur at each air quality receptor site analyzed, given the assumed simultaneous occurrence of a number of worst-case conditions: peak-hour traffic conditions, conservative vehicular operating conditions, low wind speed, low atmospheric temperature, neutral atmospheric conditions, and maximizing wind direction.

Microscale modeling is used to predict CO concentrations resulting from emissions due to motor vehicles using roadways immediately adjacent to the locations at which predictions are being made. A CO background level must be added to this value to account for CO entering the area from other sources upwind of the receptors. Background levels for this analysis were obtained from the Camden County monitoring sites, which are the closest CO monitoring locations to the project area. The background values used for the 1-hour and 8-hour CO levels, 1.9 ppm and 1.5 ppm, respectively, are the maximum of the 2nd highest levels from the past three years of data (2014–2016) at these locations. These values were conservatively used as the background for all CO modeling analyses. Future CO background levels are anticipated to be lower than existing levels due to mandated emission source reductions.

Traffic data for the air quality analysis were derived from traffic counts and other information developed as part of the Traffic Analysis Report. Output from the "Synchro8" signal timing traffic model was used to obtain signal timing parameters.

Emission factors were developed using the EPA's MOVES program, MOVES2014a. MOVES2014a is the EPA's state-of-the-art tool for estimating emissions from highway vehicles. The model is based on analyses of millions of emission test results and considerable advances in the EPA's understanding of vehicle emissions. Compared to previous tools, MOVES2014a incorporates the latest emissions data, more sophisticated calculation algorithms, increased user flexibility, new software design, and substantial new capabilities. Detailed MOVES2014a information is available upon request.

4.4.1 Screening Evaluation

A screening evaluation was performed on the 37 intersections identified in the project area as the most congested and most affected by the GCL (Table 5, "The GCL Intersection Screening"). As referenced in EPA's "Using MOVES in Project-Level Carbon Monoxide Analyses," the screening evaluation criteria recommended in EPA's "Guideline for Modeling Carbon Monoxide from Roadway Intersections" was utilized. Sites fail the screening evaluation if (1) the level of service (LOS) decreases to D or below in the GCL scenario compared to the No-Action scenario, or (2) if the delay and/or volume increase from the No-Action scenario to the GCL scenario along with a LOS OF D or below. The LOS describes the quality of traffic operating conditions, ranging from A to F, and it is measured as the duration of delay that a driver experiences at a given intersection. LOS A represents free-flow movement of traffic and minimal delays to motorists. LOS F generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in congestion. Out of the 37 intersections, the following two intersections were chosen for detailed analysis due to poor LOS, high volumes, proximity to sensitive receptors and geographical representation:

- Broadway Boulevard (551) at Delsea Drive (47): this intersection has the highest delay under the GCL and is LOS F under AM No-Action and the GCL conditions, with an increase in volume from the No-Action to the GCL condition.

- Cooper Street (CR 534) at South Evergreen Avenue (CR 553): this intersection is LOS D and has the second-highest volume and third-highest delay under the PM GCL conditions, with a worsening in delay from the No-Action to the GCL condition.

Table 5: The GCL Intersection Screening

#	Intersection	2040 No-Action						2040 The GCL					
		AM			PM			AM			PM		
		LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume
1	Martin Luther King Blvd at South 6th Street	A	7.8	1,466	B	10.4	1,446	A	7.8	1,467	A	7.2	1,460
2	Martin Luther King Blvd at Haddon Ave	D	42.8	2,624	D	36.5	2,647	C	29.9	2,586	C	27.4	2,683
3	Martin Luther King Blvd at Broadway	C	20.8	1,571	B	19.0	1,715	B	13.7	1,543	B	16.9	1,694
4	N Broadway at Hudson St	B	19.6	325	C	20.2	359	B	19.4	282	C	20.1	338
5	S Broadway (551) at Monmouth Street	B	19.7	734	B	17.7	803	B	19.3	639	B	17.4	633
6	Market Street (537 S) at South Broadway (551)	C	28.9	1,360	C	26.9	1,032	C	24.6	1,184	C	26.1	971
7	S Broadway (551) at Koehler St	B	11.7	293	B	12.9	533	B	11.5	256	B	12.8	502
8	Broadway Blvd (551) at Delsea Drive (47)	F	185.8	1,780	B	12.5	1,791	F	177.0	1,800	B	13.0	1,791
9	Broadway Blvd (551) at E. Olive Street	B	16.1	884	B	15.3	1,013	B	15.9	871	B	15.2	999
10	N. Broad Street at Edith Ave	A	3.6	945	A	6.1	1,312	A	3.6	974	A	6.2	1,357
11	E Red Bank Ave at N Evergreen Ave (650)	C	22.1	1,723	D	40.9	2,380	C	22.8	1,780	D	47.8	2,468
12	E Red Bank Ave at N Broad Street (Rte 45)	C	35.6	2,456	C	29.9	2,422	D	36.9	2,505	C	30.1	2,441
13	Cooper Street (CR 534) at S Broad St (Rte 45)	D	43.4	2,289	D	42.2	2,367	D	41.6	2,288	D	48.7	2,368
14	Cooper Street (CR 534) at S Evergreen Ave (553)	B	19.1	1,687	D	48.7	2,551	B	19.0	1,785	D	53.7	2,699
15	S Broad St (Rte 45) at E Barber Ave	C	29.0	1,124	C	34.0	2,029	D	40.4	1,164	D	38.4	2,110
16	East Barber Ave at S Evergreen Ave (553)	E	58.3	2,026	E	70.0	2,413	D	52.9	2,014	E	64.1	2,386
17	Mantua Blvd (676) at Center St	B	14.9	1,675	C	22.5	2,046	B	14.5	1,645	C	22.6	2,051
18	Tylers Mill Road at Glassboro Road	E	41.0	2,667	C	27.9	2,821	D	38.2	2,653	C	27.5	2,798
19	Lambs Road at Main St	B	15.0	795	B	13.9	1,094	B	15.0	797	B	13.9	1,108
20	Broadway Blvd (551) at Holly Ave	B	15.4	710	B	17.8	1,080	B	15.4	713	B	18.0	1,094
21	Pitman Ave (639) at S Broadway (553A)	A	6.9	488	A	9.2	702	A	7.1	507	A	9.2	690
22	Bowe Blvd at Carpenter St (682)	B	18.3	1,645	B	16.6	1,998	B	17.9	1,613	B	16.4	1,962
23	Mullica Hill Rd (Rte 322) at Bowe Blvd	F	119.1	2,212	F	105.0	2,705	E	61.5	2,130	E	66.8	2,611
24	Delsea Dr (Rte 47) at High Street (322)	C	29.9	1,969	C	32.2	2,539	C	29.0	1,866	C	34.5	2,494
25	High St E at S Main Street (Rte 553)	C	25.6	1,669	D	40.1	2,117	C	24.8	1,677	D	50.3	2,102

Table 5: The GCL Intersection Screening (continued)

#	Intersection	2040 No-Action						2040 The GCL					
		AM			PM			AM			PM		
		LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume	LOS	Delay	Volume
26	Broadway Blvd (551) at Duncan Ave	A	Unsig.	578	A	Unsig.	614	A	Unsig.	624	A	Unsig.	643
27	N. Broad Street at Park Ave	B	Unsig.	1,386	C	Unsig.	1,683	B	Unsig.	1,429	C	Unsig.	1,742
28	East Barber Ave at Railroad Ave	B	Unsig.	830	C	Unsig.	969	A	Unsig.	832	B	Unsig.	956
29	Cooper Street (CR 534) at Railroad Ave	A	Unsig.	733	B	Unsig.	1,358	A	Unsig.	776	C	Unsig.	1,466
30	Elm Ave (652) at W Jersey Ave	B	Unsig.	860	B	Unsig.	961	B	Unsig.	930	C	Unsig.	1,022
31	N East Ave at E Mantua Ave (632)	A	Unsig.	649	A	Unsig.	764	A	Unsig.	1,555	A	Unsig.	891
32	Atlantic Ave at Center St	A	Unsig.	682	A	Unsig.	1,072	A	Unsig.	686	A	Unsig.	1,110
33	Tylers Mill Road at Main Street	A	Unsig.	576	B	Unsig.	909	A	Unsig.	576	B	Unsig.	920
34	S Broadway (551) at Laurel Ave	A	Unsig.	495	A	Unsig.	790	A	Unsig.	622	A	Unsig.	805
35	Ellis St at Sewell St	A	Unsig.	697	A	Unsig.	827	A	Unsig.	683	A	Unsig.	812
36	High St at Academy St	A	Unsig.	794	A	Unsig.	700	A	Unsig.	796	A	Unsig.	688
37	Main St at Union St & Church St	A	Unsig.	720	B	Unsig.	853	A	Unsig.	773	A	Unsig.	875

Source: Glassboro-Camden Line Project Team, Traffic Analysis Report 2018

Table 6, "Traffic Impacts at Grade Crossings 2040," summarizes the results of the GCL Project Team analysis of anticipated traffic impacts at grade crossings. The results identify the peak-hour volume on the highest-volume roadway approach direction only, anticipated vehicle delay, and anticipated LOS for the at-grade crossings with the highest potential impacts. Roadway at-grade crossing delays in the GCL corridor vary widely due to train blockage time, roadway traffic volume, and estimated reductions in roadway capacity due to factors that include heavy pedestrian crossing activity. As shown in the Table 6, "Traffic Impacts at Grade Crossings 2040," the majority of at-grade crossings would operate at LOS A or B, with a couple operating at LOS C. There is one crossing that would operate at LOS E under PM peak conditions. The volumes at this crossing, however, are significantly lower (approximately 500-600 for the peak hour) than those for the selected intersections for detailed analysis (approximately 2,000 for the peak hour). As such, potential impacts at these roadway crossings are expected to be lower than those identified for the intersections selected for detailed analysis.

Table 6: Traffic Impacts at Grade Crossings 2040

Location Name	AM Peak Hour			PM Peak Hour		
	Volume	Delay	LOS	Volume	Delay	LOS
South Main Street, Glassboro, NJ	360	7.14	A	390	7.23	A
Ellis Street, Glassboro, NJ	251	6.76	A	311	6.41	A
Route 322 Mullica Hill Rd, Glassboro, NJ	475	25.52	C	574	72.47	E
Bowe Blvd, Glassboro, NJ	716	18.40	B	685	11.84	B
Carpenter St, Glassboro, NJ	621	9.79	A	639	9.30	A
S. Broadway, Pitman, NJ	285	7.16	A	456	6.21	A
Pitman Ave, Pitman, NJ	77	10.16	B	154	10.78	B
Lambs Road, Pitman, NJ	334	7.59	A	393	6.80	A
Center St, Mantua, NJ	491	6.71	A	566	6.68	A
Mantua Ave, Wenonah, NJ	435	7.66	A	433	7.53	A
Maple St, Wenonah, NJ	383	6.55	A	371	7.08	A
Elm Ave, Woodbury, NJ	370	7.55	A	452	7.08	A
E. Barber Ave, Woodbury, NJ	205	6.69	A	318	6.47	A
Cooper St, Woodbury, NJ	867	20.64	C	727	16.99	B
Olive St, Westville, NJ	225	6.37	A	248	6.48	A
Market St, Gloucester, NJ	185	6.74	A	244	6.44	A

Source: GCL Project Team Grade Crossing Analysis, 2018

Of the fourteen proposed GCL stations, nine will be served by existing or proposed parking facilities (structures or surface parking lots). Parking facilities (surface lots) will be constructed at six stations as part of the proposed GCL (South Camden, Gloucester City, Crown Point Road, Woodbury Heights, Mantua Boulevard, and Mantua-Pitman). Two stations (Woodbury and Glassboro) will be served by existing municipal parking structures, and one station (Red Bank Avenue) will be served by an existing municipal parking lot. (Mantua-Pitman Station will be served by a parking lot constructed as part of the GCL, which if and as demand calls for, may be developed in the future as a parking structure.) In sum, approximately 2,685 new parking spaces in 2025 and 4,310 spaces in 2040 would be available for GCL use. The type and size of the proposed GCL parking facilities are shown in Table 7, "Proposed GCL Parking Facilities." Parking facilities identified as "GCL" would be constructed as a part of the proposed project. Facilities identified as "Shared" are either existing or planned as part of municipal redevelopment master plans, and though not part of the proposed project, would provide parking spaces for use by GCL riders.

Table 7: Proposed GCL Parking Facilities

Station	Facility Type	2040 Parking	Exclusive (GCL) vs. Shared
South Camden	Surface	100	GCL
Gloucester City	Surface	160	GCL
Crown Point Road	Surface	325	GCL
Red Bank Avenue	Surface	500	Shared
Woodbury	Garage	1,200	Shared
Woodbury Heights	Surface	25	GCL
Mantua Blvd	Surface	300	GCL
Mantua-Pitman	Garage	1,200	GCL
Glassboro	Garage	500	Shared
	Total	**4,310**	

Source: GCL Team Analysis, 2018

4.4.2 Analysis Results

Maximum one-hour and eight-hour CO levels were predicted for the existing year (2017), opening year (2025) and design year (2040) at the two intersections selected for analysis. Maximum one-hour CO concentrations are shown in Table 8, "Predicted Worst-Case One-Hour CO Concentrations (ppm)." Maximum eight-hour CO concentrations are shown in Table 9, "Predicted Worst-Case Eight-Hour CO Concentrations (ppm)." The CO levels estimated by the model are the maximum concentrations that could be expected to occur at each air quality receptor site analyzed. This assumes simultaneous occurrence of a number of worst-case conditions: peak-hour traffic conditions, conservative vehicular operating conditions, low wind speed, low atmospheric temperature, neutral atmospheric conditions, and maximizing wind direction. CAL3QHC input and output files are available upon request.

Table 8: Predicted Worst-Case One-Hour CO Concentrations (ppm)

	2017		2025				2040			
	Existing		No-Action		The GCL		No-Action		The GCL	
Intersection	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Broadway Boulevard (551) at Delsea Drive (47)	2.4	2.2	2.2	2.1	2.1	2.2	2.0	1.9	2.0	1.9
Cooper Street (CR 534) at South Evergreen Avenue (CR 553)	2.2	2.3	2.0	2.2	2.1	2.1	1.9	1.9	1.9	2.0

Notes: Concentrations = modeled results + 1-hour CO background.
1-hour CO background = 1.9 ppm; 1-hour CO standard = 35 ppm.

Abbreviations: AM = morning; PM = evening; ppm = parts per million.

Source: Glassboro-Camden Line Project Team, 2018

Table 9: Predicted Worst-Case Eight-Hour CO Concentrations (ppm)

Intersection	2017	2025		2040	
	Existing	No-Action	The GCL	No-Action	The GCL
Broadway Boulevard (551) at Delsea Drive (47)	1.9	1.7	1.7	1.6	1.6
Cooper Street (CR 534) at South Evergreen Avenue (CR 553)	1.8	1.7	1.6	1.5	1.6

Notes: Concentrations = (modeled results x persistence factor [0.7]) + 8-hour CO background.
8-hour CO background = 1.5 ppm; 8-hour CO standard = 9 ppm.

Abbreviations: ppm = parts per million.

Source: Glassboro-Camden Line Project Team, 2018

Based on the eight-hour values presented in Table 9, "Predicted Worst-Case Eight-Hour CO Concentrations (ppm)," the GCL is predicted to have slightly lower CO levels in 2025 at both intersections evaluated, when compared to the No-Action Alternative. The GCL is predicted to have no effect on CO levels in 2040, when compared to the No-Action Alternative. No violations of the NAAQS are predicted for any of the future analysis years.

In summary, a microscale CO analysis was conducted to determine if the GCL has the potential to cause or exacerbate a violation of the applicable CO standards. The result of this analysis, which was conducted following the EPA's Guideline for Modeling Carbon Monoxide from Roadway Intersections, is that the GCL is not predicted to cause or exacerbate a violation of the NAAQS for CO.

4.5 $PM_{2.5}$ Analysis

The project is located in New Jersey's Camden and Gloucester Counties – both of which are classified as maintenance areas for the 24-hour standards for $PM_{2.5}$. As such, according to the EPA's November 2015 guidance, *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*, the project would require a quantitative PM analysis if it is deemed to be a "Project of Air Quality Concern."

Projects that require a quantitative $PM_{2.5}$ or PM_{10} hot-spot analysis, as defined in Section 93.123(b)(1) of the conformity rule, include:

- new highway projects that have a significant number of diesel vehicles, and expanded highway projects that have a significant increase in the number of diesel vehicles;
- projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles, or those that would change to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project;
- new bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location;

- expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and
- projects in or affecting locations, areas, or categories of sites which are identified in the $PM_{2.5}$ or PM_{10} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

Some examples of projects of local air quality concern that would be covered by 40 CFR 93.123(b)(1)(i) and (ii) are:

- a project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 annual average daily traffic and 8 percent or more of such annual average daily traffic is diesel truck traffic;
- new exit ramps and other highway facility improvements to connect a highway or expressway to a major freight, bus, or intermodal terminal;
- expansion of an existing highway or other facility that affects a congested intersection (operated at Level-of-Service D, E, or F) that has a significant increase in the number of diesel trucks; and,
- similar highway projects that involve a significant increase in the number of diesel transit buses and/or diesel trucks.

Some examples of projects of local air quality concern that would be covered by 40 CFR93.123(b)(1)(iii) and (iv) are:

- a major new bus or intermodal terminal that is considered to be a "regionally significant project" under 40 CFR 93.1012; and,
- an existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increases by 50 percent or more, as measured by bus arrivals.

4.5.1 Monitored Data

According to the latest monitored data for the project area (Table 3, "Ambient Air Quality Monitoring Data 2014-2016"), the past three years of data do not show any exceedances of the $PM_{2.5}$ annual or 24-hour NAAQS.

4.5.2 Traffic

According to the regional traffic analysis, the project is expected to reduce regional VMT in 2040 by approximately 2 percent, due to mode shift from autos to the GCL. Furthermore, the project would not affect diesel truck traffic on roadways in the region.

According to the local traffic analysis (Table 5, "The GCL Intersection Screening"), in the AM peak period, 6 of the 37 intersections analyzed would experience an improvement in LOS with the project, while 2 intersections would experience a deterioration in LOS. 29 intersections would experience no change in

LOS with the project in the AM peak period. In the PM peak period, 5 of the 37 intersections analyzed would experience an improvement in LOS with the project, while 3 intersections would experience a deterioration in LOS. 29 intersections would experience no change in LOS with the project in the PM peak period.

As shown in the tables, the project would improve or have no effect on LOS at most intersections in the project area, while only several intersections would experience a deterioration in LOS. Of the intersections that experience a deterioration in LOS, none would be LOS E or below under Build conditions. In addition, there would be no significant changes to bus service in the project area. Therefore, any deterioration in LOS would generally be due to the overall increase in volume rather than a significant increase in diesel vehicles.

4.5.3 Train Operations

The project would utilize light DMUs, as opposed to typically used heavy DMUs. Due to better fuel efficiency compared to heavy DMUs, light DMUs would use less energy and, therefore, emit fewer pollutants than the typically used heavy DMUs.

The project anticipates the use of Stadler GTW light DMUs with diesel engines. The Stadler GTW 2/6 and 2/8 articulated railcars use two 450 kW (600 horsepower) engines per vehicle, providing 100 percent redundancy for traction power and other critical systems. According to Stadler, the Glassboro-Camden Line could potentially use an even smaller, lighter and more efficient vehicle than the Stadler 2/6 and 2/8; but for the purpose of this report, it is assumed that the project would use the Stadler GTW.

Table 10, "Tier 4 Exhaust Emission Standards After 2014 Model Year (g/kW-hr)," presents the EPA's regulations on the maximum amount of emissions an off-road engine can emit for both the project's vehicles (Stadler light DMU) and the heavier DMUs typically used (many other diesel DMUs on the U.S. market use multiple 625 kW engines). The EPA regulations require the exhaust emissions to meet these EPA Tier 4 final requirements for model year 2015 and beyond. It should be noted that, the smaller the engine (horsepower) used, the more stringent the EPA standards become (on a per horsepower basis). Typical DMUs are heavier with larger engines, and are therefore allowed to produce more pollution on a per horsepower basis.

Table 10: Tier 4 Exhaust Emission Standards After 2014 Model Year (g/kW-hr)

Manufacturer	Engine Power	Pollutant				
		CO	NMHC	NMHC+NO_X	NO_X	PM
Stadler's light DMU 450 kw	130 ≤ kW ≤ 560 (175 ≤ hp ≤ 750)	3.5	0.19	—	0.4	0.02
Typical Heavy DMU 625 kw	560 ≤ kW (750 ≤ hp)	3.5	0.19	—	3.5	0.04

Source: U.S. Government Printing Office, https://www.ecfr.gov/cgi-bin/text-idx?SID=5bd49186c6de428e7d6446a56baab96c&mc=true&node=pt40.36.1039&rgn=div5#se40.36.1039_1101

An analysis of the potential impacts associated with train operations was conducted using EPA's AERSCREEN model (see Section 4.7, "Train Operations"). The modeling assumed worst-case conditions, including the slowest speeds, closest receptors, full conversion of NO_X to NO_2 and maximum number of train passbys. Based on this analysis, predicted worst-case $PM_{2.5}$ train emissions would not exceed the applicable NAAQS (Table 11, "Predicted Worst-Case Train $PM_{2.5}$ Concentrations").

Table 11: Predicted Worst-Case Train $PM_{2.5}$ Concentrations

Pollutant	Averaging Time	Predicted Concentration*	Applicable NAAQS
$PM_{2.5}$	24-hour	29 μg/m^3	35 μg/m^3
*Concentrations include maximum background levels μg/m^3 = micrograms per cubic meter			

Source: Glassboro-Camden Line Project Team, 2018

4.5.4 Interagency Consultation

As detailed in this report, the project is expected to utilize trains meeting the highest level of emission controls as required by the EPA, and is not predicted to cause a violation of the applicable $PM_{2.5}$ NAAQs. The project would reduce regional roadway VMT and not increase diesel bus service. NJ TRANSIT anticipates operating a similar bus network, level and span of service during the anticipated construction phase and operations phase for the Glassboro-Camden Line.

The above project-related data (traffic and train operations) was presented to the Interagency Working Group to assist with the decision as to whether the GCL project would be considered a "Project of Air Quality Concern." On March 21, 2014, the Interagency Working Group came to the conclusion that the Glassboro-Camden Line is <u>not</u> a "Project of Air Quality Concern." Following the revised traffic analysis of May 2014, this decision was confirmed by the Interagency Working Group in June 2014. Following further traffic revisions in March 2018, this decision was again confirmed by the Interagency Working Group on March 30, 2018. As such, no further analysis is required.

4.6 Greenhouse Gas Analysis

Table 12, "2040 Daily Greenhouse Gas Emission Burdens (Metric Tons)," presents the GHG emission burdens for the No-Action Alternative and the GCL in 2040. As shown in the table, the GCL is predicted to slightly increase GHG emissions, as compared to the No-Action Alternative.

Table 12: 2040 Daily Greenhouse Gas Emission Burdens (Metric Tons)

Alternative	Carbon Dioxide Equivalents (CO_2e)
No-Action	739
The GCL	744
% Change from No-Action	1%

Source: Glassboro-Camden Line Project Team, 2018

4.7 Train Operations

An analysis of the potential impacts associated with train operations was conducted using EPA's AERSCREEN model. The AERSCREEN model estimates worst-case pollutant concentrations for a single source, such as train passbys, at a particular location. The modeling assumed worst-case conditions, including the slowest speeds, closest receptors, full conversion of NO_X to NO_2 and maximum number of train passbys. According to the analysis, predicted worst-case train emissions would not exceed the applicable NAAQS (Table 13, "Predicted Worst-Case Train Passby Emissions).”

Table 13: Predicted Worst-Case Train Passby Emissions

Pollutant	Averaging Time	Predicted Concentration*	Applicable NAAQS
CO	1-hour	2 ppm	35 ppm
$PM_{2.5}$	24-hour	29 µg/m^3	35 µg/m^3
NO_2	1-hour	81 ppb	100 ppb
*Concentrations include maximum background levels ppm = parts per million; ppb = parts per billion; µg/m^3 = micrograms per cubic meter			

Source: Glassboro-Camden Line Project Team, 2018

4.8 Maintenance Facilities

The Glassboro-Camden Line assumes two separate vehicle maintenance facilities to store and service the anticipated 18-vehicle fleet. The Woodbury Heights Vehicle Maintenance Facility, in the middle of the line in Woodbury Heights (Figure 9, "Woodbury Heights VMF Location"), would function as a light-maintenance location and would host activities such as inspection, cleaning, fueling and overnight storage. The Glassboro Vehicle Maintenance Facility (Glassboro VMF), at the end of the line in Glassboro (Figure 10, "Glassboro VMF Location"), would operate as a full-service maintenance and vehicle storage facility. The Glassboro VMF would host activities such as periodic vehicle inspections; exterior vehicle washing; wheel truing and sanding; truck repair and truck change-out; painting and body work; maintenance of way staging; electronic component repair; and mechanical component repair. A complete list of the activities associated with each of the vehicle maintenance facilities is shown in Table 14, "Activities at Vehicle Maintenance Facilities."

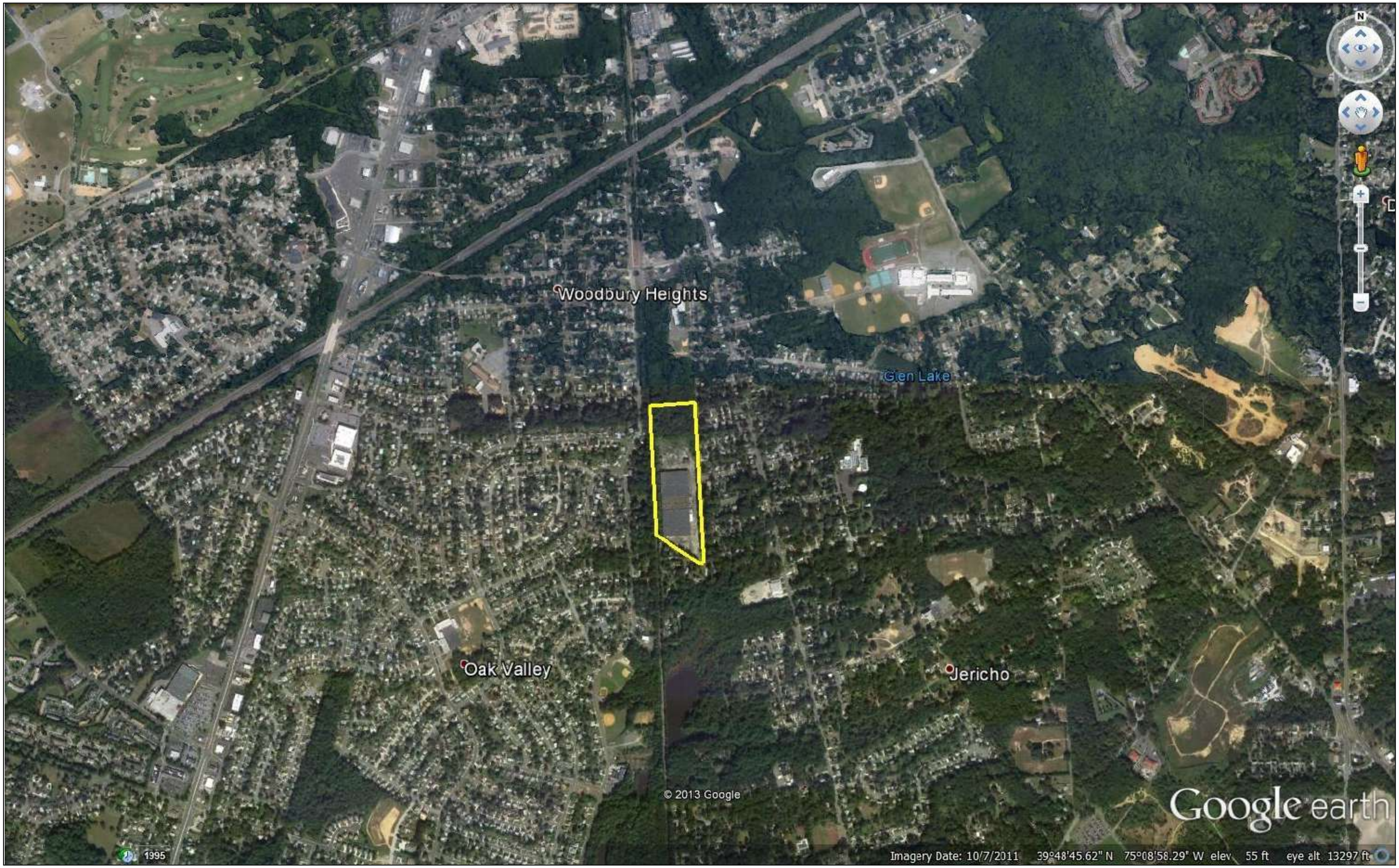

Figure 9: Woodbury Heights VMF Location

Source: GCL Project Team, 2020.

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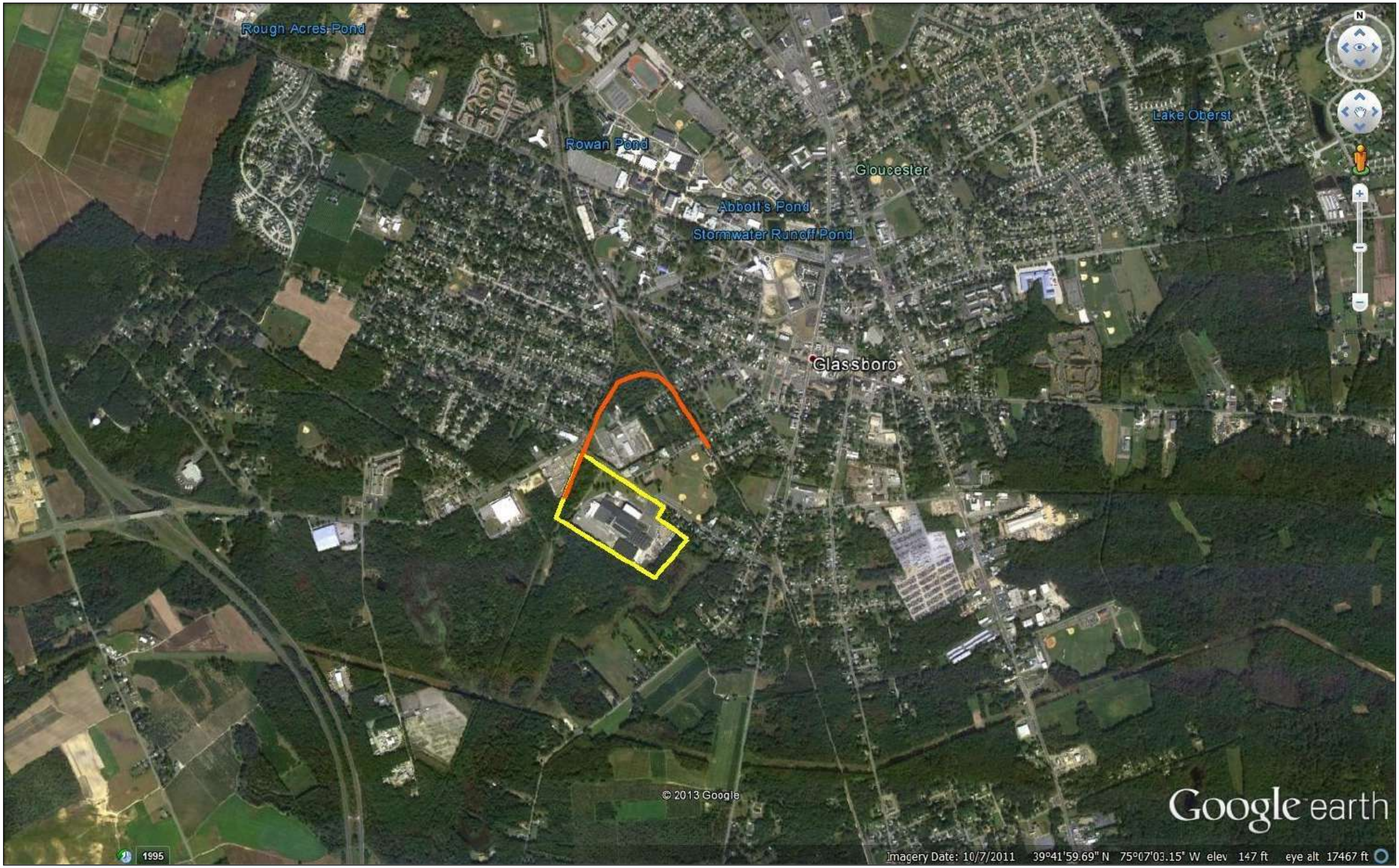

Figure 10: Glassboro VMF Location

Source: GCL Project Team, 2020.

GCL
GLASSBORO-CAMDEN LINE

Table 14: Activities at Vehicle Maintenance Facilities

Activity	Glassboro VMF	Woodbury Heights VMF
Vehicle Storage	X	X
Daily Vehicle Inspections	X	X
Periodic (Bi-wk, Monthly, etc) Vehicle Inspections	X	
Vehicle Interior Cleaning	X	X
Vehicle Exterior Cleaning (Car Washer)	X	
Diesel Fueling	X	X
Wheel Truing / Sanding	X	
Truck Repair / Change-out	X	
Painting / Body Work	X	
Maintenance of Way staging	X	
Electronic component repair	X	
Milling / Welding / Mechanical component repair	X	

Source: Glassboro-Camden Line Project Team, 2018

Most activities at the VMF would occur between 5 A.M. and 7 P.M. Approximately half of the fleet would be fueled each day, primarily between 7 P.M. and midnight. Some rail car preventive maintenance and inspection work would also be done in evening hours. By midnight, the activities would drop off significantly and would primarily focus on cleaning of the vehicles and preparing for the start of the next service day.

During the overnight storage period, trains in both yards would be shut down. During cold weather, trains would be plugged into ground power systems so they would not be running all night. Each train would be started approximately 15-30 minutes before pull out. As such, the trains would not be idling for extensive periods of time at the VMF locations.

The Glassboro VMF could have the potential for harmful emissions associated with spray painting. At this point, the details of the spray booths (location, size, duration of use) are unknown. However, because the Glassboro VMF is located adjacent (less than 100 feet) to residential land uses, the spray booths should be located as far away from these residential land uses as possible (i.e., in the center of the facility) in order to avoid the potential for air quality impacts and health hazards from spray paint operations.

4.9 Construction

In general, construction-related effects of the project would be limited to short-term increased fugitive dust and mobile source emissions during construction. State and local regulations regarding dust control and other air quality emission reduction controls should be followed.

4.9.1 Fugitive Dust Emissions

Fugitive dust is airborne particulate matter, generally of a relatively large particulate size. Construction-related fugitive dust would be generated by haul trucks, concrete trucks, delivery trucks, and earth-moving vehicles operating around the construction sites. This fugitive dust would be caused by particulate matter that is re-suspended ("kicked up") by vehicle movement over paved and unpaved roads, dirt tracked onto paved surfaces from unpaved areas at access points, and material blown from uncovered haul trucks.

Generally, the distance that particles drift from their source depends on their size, the emission height, and the wind speed. Small particles (30 to 100 micron range) can travel several hundred feet before settling to the ground. Most fugitive dust, however, is comprised of relatively large particles (that is, particles greater than 100 microns in diameter). These particles are responsible for the reduced visibility often associated with this type of construction. Given their relatively large size, these particles tend to settle within 20 to 30 feet of their source.

To minimize the amount of construction dust generated, the guidelines below are recommended:

- Site Preparation:
  - Minimize land disturbance
  - Use watering trucks to minimize dust
  - Cover trucks when hauling dirt
  - Stabilize the surface of dirt piles if they are not removed immediately
  - Use windbreaks to prevent accidental dust pollution
  - Limit vehicular paths and stabilize temporary roads
  - Pave all unpaved construction roads and parking areas to road grade for a length no less than 50 feet from where such roads and parking areas exit the construction site to prevent dirt from washing onto paved roadways
- Construction
  - Cover trucks when transferring materials
  - Use dust suppressants on unpaved traveled paths
  - Minimize unnecessary vehicular and machinery activities
  - Minimize dirt track-out by washing or cleaning trucks before leaving the construction site. An alternative to this strategy is to pave a few hundred feet of the exit road just before entering the public road.
- Post-Construction
  - Re-vegetate any disturbed land not used
  - Remove unused material
  - Remove dirt piles
  - Re-vegetate all vehicular paths created during construction to avoid future off-road vehicular activities

4.9.2 Mobile Source Emissions

Because CO emissions from motor vehicles generally increase with decreasing vehicle speed, disruption of traffic during construction (such as a temporary reduction of roadway capacity and increased queue lengths) could result in short-term, elevated concentrations of CO. To minimize the amount of emissions generated, every effort should be made during construction to limit disruption to traffic, especially during peak travel hours.

4.10 Conclusions

The purpose and need of the proposed project focuses on meeting the current and future regional transportation needs of the area. The project is currently included in the DVRPC TIP as the Second Phase of River LINE LRT/PATCO Extension, under Transit Rail Initiatives, DB# T300. The proposed project is not predicted to cause or exacerbate a violation of the NAAQS, nor increase MSAT levels above existing levels. The proposed project is predicted to slightly increase regional emission burdens; as an approved project on the TIP, however, the project emissions are incorporated into the overall plan for the area to meet ambient air quality standards. The Interagency Working Group concluded that the Glassboro-Camden Line is not a "Project of Air Quality Concern" with regards to $PM_{2.5}$. As such, no further analysis of $PM_{2.5}$ impacts is required.

Construction-related effects of the proposed project would be limited to short-term increased fugitive dust and mobile source emissions during construction. State and local regulations regarding dust control and other air quality emission reduction controls should be followed.

5 REFERENCES

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Appendix 10-A: Agency Correspondence

Memorandum

PARSONS BRINCKERHOFF

To: Interagency Working Group

From: Glassboro-Camden Line Project Team

Date: July 8, 2014

Subject: Glassboro-Camden Line: $PM_{2.5}$ Project of Air Quality Concern Determination (With Updated Traffic as of June 2014)

Note: This memo has been updated since its initial circulation in January 2014 to reflect new traffic and ridership assumptions. The updated assumptions only slightly modify the anticipated project impacts and the net impact of the anticipated project on regional Air Quality is essentially unchanged from the January 2014 memo.

The Glassboro-Camden LRT (herein referred to as "the project") is located in New Jersey's Camden and Gloucester Counties – both of which are classified as nonattainment areas for the annual and 24-hour standards for $PM_{2.5}$. As such, according to EPA's November 2013 guidance, *Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*, the project would require a quantitative PM analysis if it is deemed to be a "Project of Air Quality Concern."

Projects which require a quantitative $PM_{2.5}$ or PM_{10} hot-spot analysis, as defined in Section 93.123(b)(1) of the conformity rule, include:

- New highway projects that have a significant number of diesel vehicles, and expanded highway projects that have a significant increase in the number of diesel vehicles;
- Projects affecting intersections that are at Level-of-Service D, E, or F with a significant number of diesel vehicles, or those that will change to Level-of Service D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project;
- New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location;
- Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location; and
- Projects in or affecting locations, areas, or categories of sites which are identified in the $PM_{2.5}$ or PM_{10} applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

Some examples of projects of local air quality concern that would be covered by 40 CFR 93.123(b)(1)(i) and (ii) are:

- A project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 annual average daily traffic (AADT) and 8% or more of such AADT is diesel truck traffic;
- New exit ramps and other highway facility improvements to connect a highway or expressway to a major freight, bus, or intermodal terminal;
- Expansion of an existing highway or other facility that affects a congested intersection (operated at Level-of-Service D, E, or F) that has a significant increase in the number of diesel trucks; and,
- Similar highway projects that involve a significant increase in the number of diesel transit busses and/or diesel trucks.

Some examples of projects of local air quality concern that would be covered by 40 CFR93.123(b)(1)(iii) and (iv) are:

- A major new bus or intermodal terminal that is considered to be a "regionally significant project" under 40 CFR 93.1012; and,

- An existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increases by 50% or more, as measured by bus arrivals.

The purpose of this memo is to present project-related data (traffic and train operations) to the interagency group to assist with the decision as to whether the Glassboro-Camden LRT project would be considered a "Project of Air Quality Concern."

Existing Conditions

The State of New Jersey has five distinct climate regions. The geology, distance from the Atlantic Ocean, and prevailing atmospheric flow patterns produce distinct variations in the daily weather between each of the regions. These five regions include: Northern, Central, Pine Barrens, Southwest and Coastal.

The proposed project is within the Southwest zone. The Southwest Zone lies between sea level and approximately 100 feet above sea level. The close proximity to Delaware Bay adds a maritime influence to the climate of this region. The Southwest has the highest average daily temperatures in the state and, without sandy soils, tends to have higher nighttime minimum temperatures than in the neighboring Pine Barrens. This region receives less precipitation than the Northern and Central regions of the state, as there are no orographic features, and it is farther away from the Great Lakes-St. Lawrence storm track. It is also far enough inland to be away from the heavier rains from some coastal storms, thus it receives less precipitation than the Coastal Zone.

Prevailing winds are from the southwest, except in winter when west to northwest winds dominate. High humidity and moderate temperatures prevail when winds flow from the south or east. The moderating effect of the water also allows for a longer growing season. Autumn frosts usually occur about four weeks later than in the North and the last spring frosts are about four weeks earlier, giving this region the longest growing season in New Jersey (Office of New Jersey State Climatologist).

Table 1 presents the latest monitored data for $PM_{2.5}$ in the project area at two monitor locations in Amden County. As shown in the table, the past three years of data do not show any exceedences of the $PM_{2.5}$ annual or 24-hour National Ambient Air Quality Standards (NAAQS).

Table 1 – $PM_{2.5}$ Ambient Air Quality Monitoring Data ($\mu g/m^3$)

Averaging Time	266 Spruce Street Camden County*	Morris Delair Water Treatment Plant Camden County			EPA Primary NAAQS
	2012	*2010*	*2011*	*2012*	
Annual	9.7	9.5	10.1	9.0	*12.0*
24-Hour	22	23	24	20	*35*

*Data only available for 2012 at this location
Source: EPA Office of Air Quality Planning and Standards (AIRData); http://www.epa.gov/air/data/geosel.html

Regional Traffic

The project is expected to reduce regional VMT due to mode shift from autos to the LRT. Furthermore, the project would not affect diesel truck traffic on roadways in the region. Table 2 presents the regional 2035 vehicles mile traveled (VMT) in the region under No Build and Build conditions. As shown in the table, the project is expected to reduce regional VMT by 2.5% in the AM period and by 1.8% in the PM period.

Table 2 – 2035 Regional VMT

AM			PM		
No Build	Build	*% Change*	No Build	Build	*% Change*
851,536	830,322	-2.5%	1,020,688	1,002,241	-1.8%

Source: Delaware Valley Planning Commission and GCL Project Team, 2013

Local Traffic

Thirty-seven intersections within the study area were screened to determine the project's impact on level-of-service (LOS) and delay (Table 3 and Table 4).

As shown in Table 3, in the AM period, 13 of the 37 intersections analyzed will experience an improvement in LOS and/or delay with the project, while 4 intersections will show no change in delay and 11 intersections will show no change in LOS. 8 intersections in the AM period will experience an increase in delay; these 8 intersections, however, will not experience a deterioration in LOS. One intersection in the AM period will show a decrease from LOS A to LOS B with the project.

In the PM period, 17 of the 37 intersections analyzed will experience an improvement in LOS and/or delay with the project, while 5 intersections will show no change in delay and 11 intersections will show no change in LOS. 3 intersections in the PM period will experience an increase in delay; these 3 intersections, however, will not experience a deterioration in LOS. One intersection in the PM period will show a decrease from LOS A to LOS C with the project.

As shown in the tables, the project will be improving or having no effect on LOS and delay at most intersections in the project area, while only two intersections would experience a deterioration in LOS (one in the AM period and one in the PM period); neither of these two intersections would decrease below LOS C. In addition, there will be no significant changes to bus service in the project area. Therefore, any deterioration in LOS would generally be due to the overall increase in volume rather than a significant increase in diesel vehicles.

Table 3 – 2035 AM Intersection LOS

Intersection	No Build			Build		
	Volume	LOS	Delay	Volume	LOS	Delay
Martin Luther King Blvd at South 6th Street	1,543	B	16.4	1,470	B	13.6
Martin Luther King Blvd at Haddon Ave	2,825	E	59.8	2,693	C	33.0
Martin Luther King Blvd at Broadway	1,720	B	18.4	1,639	B	13.2
N Broadway at Hudson St	314	B	19.7	305	B	19.5
S Broadway (551) at Monmouth Street	310	B	16.4	301	B	16.3
Market Street (537 S) at South Broadway (551)	654	C	20.2	633	C	20.0
S Broadway (551) at Koehler St	296	B	11.7	287	B	11.7
Broadway Blvd (551) at Delsea Drive (47)	2,218	F	481.3	2,263	F	119.2
Broadway Blvd (551) at E. Olive Street	1,194	C	19.9	1,188	B	19.7
N. Broad Street at Edith Ave	1,006	A	4.1	1,002	A	4.1
E Red Bank Ave at N Evergreen Ave (650)	1,833	C	24.0	1,832	C	24.1
E Red Bank Ave at N Broad Street (Rte 45)	2,098	C	31.3	2,174	C	33.4
Cooper Street (CR 534) at S Broad St (Rte 45)	2,352	E	64.3	2,377	D	38.6
Cooper Street (CR 534) at S Evergreen Ave (553)	1,798	C	22.6	1,999	C	24.0
S Broad St (Rte 45) at E Barber Ave	1,196	D	47.6	1,222	D	54.2
East Barber Ave at S Evergreen Ave (553)	1,675	D	46.2	1,690	D	48.4
Mantua Blvd (676) at Center St	1,075	B	13.4	1,069	B	13.4
Tylers Mill Road at Glassboro Road	1,657	C	20.6	2,037	C	29.6
Lambs Road at Main St.	788	B	13.5	781	B	13.4
Broadway Blvd (551) at Holly Ave	702	B	14.7	698	B	14.7
Pitman Ave (639) at S Broadway (553A)	338	A	6.0	336	A	6.1
Bowe Blvd at Carpenter St (682)	1,634	C	20.5	1,613	C	20.0
Mullica Hill Rd (Rte 322) at Bowe Blvd	1,936	F	85.7	1,908	F	81.1
Delsea Dr (Rte 47) at High Street (322)	1,954	C	28.3	1,930	C	28.0
High St E at S Main Street (Rte 553)	1,183	B	15.2	1,390	B	17.9
Broadway Blvd (551) at Duncan Ave	798	A	-	880	A	-
N. Broad Street at Park Ave	1,477	B	-	1,469	B	-
East Barber Ave at Railroad Ave	646	A	-	644	A	-
Cooper Street (CR 534) at Railroad Ave	723	A	-	930	A	-
Elm Ave (652) at W Jersey Ave	893	B	-	880	B	-
N East Ave at E Mantua Ave (632)	624	A	-	619	A	-
Atlantic Ave at Center St	673	A	-	669	A	-
Tylers Mill Road at Main Street	567	A	-	562	A	-
S Broadway (551) at Laurel Ave	490	A	-	487	A	-
Ellis St at Sewell St	692	A	-	683	A	-
High St at Academy St	806	A	-	796	A	7.5
Main St at Union St & Church St	737	A	-	871	B	-

Table 4 – 2035 PM Intersection LOS

Intersection	No Build			Build		
	Volume	LOS	Delay	Volume	LOS	Delay
Martin Luther King Blvd at South 6th Street	1,127	B	14.6	1,529	B	12.0
Martin Luther King Blvd at Haddon Ave	2,329	D	35.5	2,312	C	33.6
Martin Luther King Blvd at Broadway	1,118	B	18.9	1,517	B	14.6
N Broadway at Hudson St	354	C	20.0	337	B	19.8
S Broadway (551) at Monmouth Street	810	B	16.5	768	B	16.0
Market Street (537 S) at South Broadway (551)	987	C	26.0	935	C	25.2
S Broadway (551) at Koehler St	536	B	13.0	509	B	12.8
Broadway Blvd (551) at Delsea Drive (47)	2,277	E	73.5	2,364	C	21.5
Broadway Blvd (551) at E. Olive Street	1,170	C	20.2	1,165	C	20.2
N. Broad Street at Edith Ave	1,406	A	7.7	1,399	A	7.7
E Red Bank Ave at N Evergreen Ave (650)	2,550	F	91.3	2,538	F	89.5
E Red Bank Ave at N Broad Street (Rte 45)	2,604	D	38.5	2,633	D	39.6
Cooper Street (CR 534) at S Broad St (Rte 45)	2,601	E	70.4	2,542	C	34.8
Cooper Street (CR 534) at S Evergreen Ave (553)	2,735	E	69.0	2,822	C	34.9
S Broad St (Rte 45) at E Barber Ave	2,175	E	71.8	2,178	E	57.3
East Barber Ave at S Evergreen Ave (553)	2,491	F	163.7	2,491	F	163.6
Mantua Blvd (676) at Center St	1,693	C	20.8	1,674	C	20.6
Tylers Mill Road at Glassboro Road	2,255	C	25.0	2,523	C	31.1
Lambs Road at Main St.	1,099	B	13.4	1,092	B	13.4
Broadway Blvd (551) at Holly Ave	1,084	B	18.0	1,077	B	18.0
Pitman Ave (639) at S Broadway (553A)	673	A	9.3	668	A	9.2
Bowe Blvd at Carpenter St (682)	1,922	B	19.7	1,920	B	19.7
Mullica Hill Rd (Rte 322) at Bowe Blvd	1,734	C	32.4	1,731	C	32.2
Delsea Dr (Rte 47) at High Street (322)	2,443	C	32.1	2,437	C	31.8
High St E at S Main Street (Rte 553)	1,569	C	22.6	1,752	C	30.0
Broadway Blvd (551) at Duncan Ave	872	A	-	1,014	C	-
N. Broad Street at Park Ave	1,804	C	-	1,794	C	-
East Barber Ave at Railroad Ave	861	A	-	854	A	-
Cooper Street (CR 534) at Railroad Ave	1,455	C	-	1,551	C	-
Elm Ave (652) at W Jersey Ave	974	B	-	961	B	-
N East Ave at E Mantua Ave (632)	737	A	-	729	A	-
Atlantic Ave at Center St	1,096	A	-	1,085	A	-
Tylers Mill Road at Main Street	928	B	-	920	B	-
S Broadway (551) at Laurel Ave	792	A	-	789	A	-
Ellis St at Sewell St	794	A	-	793	A	-
High St at Academy St	676	A	-	674	A	6.2
Main St at Union St & Church St	820	B	-	939	B	-

Train Operations

The project would utilize light diesel multiple units (DMUs), as opposed to typically used heavy DMUs. Due to better fuel efficiency compared to heavy DMUs, light DMUs would use less energy and, therefore, emit fewer pollutants than the typically used heavy DMUs.

The project is expected to use Stadler GTW[1] light DMUs with diesel engines. The Stadler GTW 2/6 and 2/8 articulated railcars use two 450 kW (600 hp) engines per vehicle, providing 100% redundancy for traction power and other critical systems. According to Stadler, the Glassboro-Camden Line could potentially use an even smaller, lighter and more efficient vehicle than the Stadler 2/6 and 2/8; but for the purpose of this memo, it is assumed that the project would use the Stadler GTW.

Table 5 presents the EPA's regulations on the maximum amount of emissions an off-road engine can emit for both the project's vehicles (Stadler light DMU) and the heavier DMUs typically used (many other diesel DMUs on the U.S. market use are currently using multiple 625 kW engines). EPA regulations require the exhaust emissions to meet these EPA Tier 4 final requirements for model year 2015 and beyond. It should be noted that, the smaller the engine (horse power) used, the more stringent the EPA standards become (on a per horse power basis). Typical DMUs are heavier with larger engines, and are therefore allowed to produce more pollution on a per horse power basis.

Table 5 – Tier 4 Exhaust Emission Standards After 2014 Model Year (g/kW-hr)

Manufacturer	Engine Power	Pollutant				
		CO	NMHC	NMHC+NO_X	NO_X	PM
Stadler's light DMU 450 kw	130 ≤ kW ≤ 560 (175 ≤ hp ≤ 750)	3.5	0.19	N/A	0.4	0.02
Typical Heavy DMU 625 kw	560 ≤ kW (750 ≤ hp)	3.5	0.19	N/A	3.5	0.04

Source: U.S. Government Printing Office, http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=0a57ac29b59ade8455648e60e739a181&rgn=div5&view=text&node=40:34.0.1.1.5&idno=40#40:34.0.1.1.5.2.1.1

[1] http://www.stadlerrail.com/en/vehicles/gtw/

Conclusion

As detailed in this memo, the project is expected to utilize trains meeting the highest level of emission controls as required by the EPA, reduce regional roadway VMT and not increase diesel bus service. NJ Transit has alerted the GCL Project Team that their bus network, services and hours of service will remain the same during the anticipated construction phase and operations phase for the Glassboro-Camden Line.

Jandoli, Christopher

From:	Sean Greene <sgreene@dvrpc.org>
Sent:	Friday, March 30, 2018 1:17 PM
To:	Siulagi, Alma
Cc:	Jandoli, Christopher
Subject:	Re: Glassboro-Camden Light Rail - Updated Interagency Consultation Memo

Alma,
I received emails from NJ Transit and US EPA Region II indicated that your project was not of air quality concern. I did nit receive any emails to the contrary by the agreed upon deadline. Please take this as concurrence of the ICG that the projects is not a project of air quality concern.

Sean

Sean Greene | Air Quality Programs Manager

Delaware Valley Regional Planning Commission
190 N. Independence Mall West, 8th Floor
Philadelphia, PA 19106-1520
215.238.2860www.dvrpc.org

On Mon, Mar 19, 2018 at 12:09 PM, Siulagi, Alma <Alma.Siulagi@wsp.com> wrote:

> Hi Sean -
>
> I'm a part of the environmental team working on the Glassboro-Camden Light Rail DEIS, which has resumed from 2014. We wanted to send an updated memo for circulation among the Interagency Working Group and an updated decision regarding the anticipated air quality impacts of the project.

Previously, the determination of the group was that the project is not one of air quality concern. Since that determination, the GCL Team, along with the DVRPC travel demand forecasting team, updated the project's ridership estimates, the background growth estimates, and shifted the alignment in a few places. The memo that is attached reflects these changes. Also attached are the most recent set of communications (2014) between DVRPC and the GCL team concerning the Interagency Working Group's ruling on the project.

Please let me know if you need any additional information, and we appreciate your help.

Alma Siulagi

Transportation Planner

wsp

Phone: +1 215 209 1238

Mobile: +1 503 320 5958

Email: alma.siulagi@wsp.com

WSP USA

1600 John F. Kennedy Boulevard, Suite 510
Philadelphia, PA 19103

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---------- Forwarded message ----------
From: "Tadross, Edward" <Edward.Tadross@wsp.com>
To: "Lovegrove, Alice" <Alice.Lovegrove@wsp.com>
Cc: "Tadross, Edward" <Edward.Tadross@wsp.com>
Bcc:
Date: Mon, 12 Mar 2018 13:59:42 +0000
Subject: FW: GCL - Updated Interagency Consultation Memo

FYI the last decision received (we went thru the process twice)

From: Jandoli, Christopher
Sent: Tuesday, July 15, 2014 9:41 AM
To: Hobbick, Cade W. <Cade.Hobbick@stvinc.com>; Alexiou-Hidalgo, Christina <christina.alexiou-hidalgo@stvinc.com>
Cc: Mason, Mary Ann <MasonM@pbworld.com>; Tadross, Edward <Tadross@pbworld.com>; Lovegrove, Alice <Lovegrove@pbworld.com>
Subject: FW: GCL - Updated Interagency Consultation Memo

Cade and Christina –

I just received this email from DVRPC. Seems as if the GCL project is, as we expected, still not a project of air quality concern.

Chris

From: Greene, Sean [mailto:sgreene@dvrpc.org]
Sent: Tuesday, July 15, 2014 9:41 AM
To: Jandoli, Christopher
Subject: FW: GCL - Updated Interagency Consultation Memo

Chris,

I have not received any comments concerning the impact of changes of projected ridership on the ICG finding of "not a project of air quality concern" for the GCL project.

Having heard no concerns from the ICG by the appointed date, you can be assured that this ruling is still applicable to the project.

Sean

From: Greene, Sean
Sent: Tuesday, July 08, 2014 1:53 PM

To: 'James Goveia'; 'Jamie DeRose'; 'Jim Koroniades'; 'John.Gorgol@dep.state.nj.us'; 'Matt Laurita'; 'Tom Marchwinski'; Victor Waldron; Charles Grill (charles.grill@dot.state.nj.us); Tony Sabiduss
Cc: 'John.Manzoni@stvinc.com'; 'Christina.alexiou-hidalgo@stvinc.com'; 'Lovegrove@pbworld.com'; Lane, Brad; Boyer, Mike; 'RPalladino@njtransit.com'; Jandoli@pbworld.com
Subject: FW: GCL - Updated Interagency Consultation Memo

New Jersey ICG members,

Please see the email below from Parsons regarding the revised ridership numbers for the Gloucester County Rail line. Please let me know if you think these changes impact the finding of "not a project of air quality concern" by the end of business on Monday July 14, 2014.

If I do not receive a response to the contrary by the end of Monday afternoon, we will assume that this change in projected ridership does not impact that previous finding.

Thanks for your time.

Sean

From: Jandoli, Christopher [mailto:Jandoli@pbworld.com]
Sent: Tuesday, July 08, 2014 1:34 PM
To: Greene, Sean
Cc: Hobbick, Cade W.; Alexiou-Hidalgo, Christina
Subject: GCL - Updated Interagency Consultation Memo

Sean –

In January we provided a memo that you circulated on behalf of the Glassboro-Camden Line project regarding the anticipated air quality impacts of the project.

The determination of the Interagency group was that the project is not one of air quality concern.

Since that determination, the GCL Team, along with the DVRPC travel demand forecasting team, updated the project's ridership estimates and background growth estimates.

Attached is a memo updated to reflect these changes.

It is our belief that these changes are only minimal and its status concerning anticipated air quality impact is essentially unchanged. But we wanted to give the Interagency group another opportunity to review our shared data.

Both the original and the updated version of the memo are attached. Please let me know if you need any addition information and we appreciate your help with this.

Chris
